

Farbwerke vorm. Meister Lucius & Brüning
Hoechst on Main.

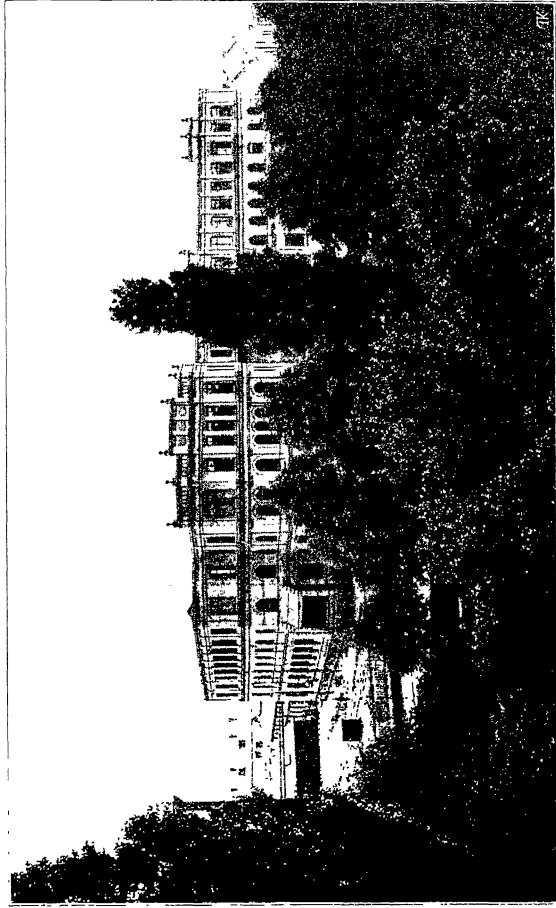
Pocket Manual
for
Dyers, Printers, Lake and Paper Makers
on
the application of
the Coal Tar Colours.

Enlarged Edition.

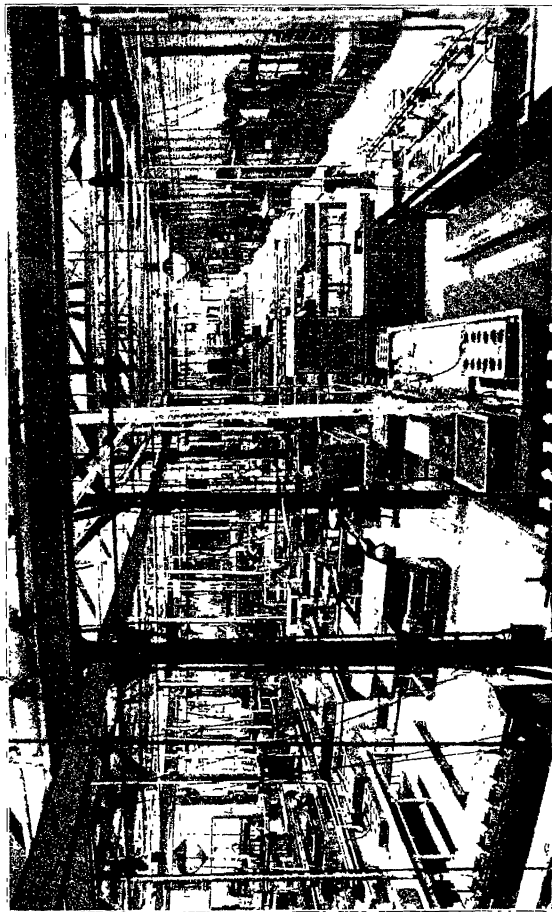
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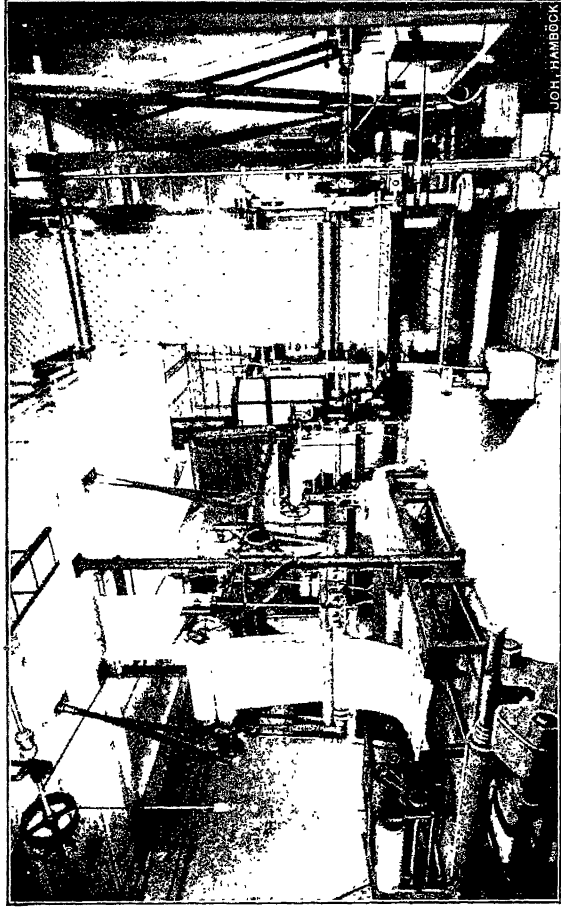
FARBWERKE VORL MEISTER LUCIUS & BRÜNING, HOECHST A.M.



Dyehouse (exterior)



Dyehouse (interior)



JOH. HAMBOCK

Printing Department

PREFACE.

This little work, which represents the third and enlarged edition of our Pocket Manual, is again intended to serve our business friends as a handy reference book, and we dedicate it to them, wishing that it may serve its purpose.

It contains detailed notes upon the application and characteristics of all our products, and we have classified the contents according to the different branches of the dyeing industry, subdividing the various headings with respect to the employment and properties of the colours.

The many-sidedness of the subject, made it impossible to treat the different matters exhaustively; however, we hope that this little publication will be a welcome guide and adviser in practical dyeing.

Farbwerke vorm. Meister Lucius & Brüning
Hoechst on Main.

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The following tables contain a systematic compilation of the dyeing and fastness properties of our wool and cotton colours.

In order to criticise the properties of the different dyestuffs, a series of tests — as are most commonly used in different industries — have been carefully carried out, and these have been made comparable with each other as to their degree of fastness, by the figures 1—5. Furthermore, the experience gained by making practical trials on a large scale has also been taken into consideration in compiling these figures.

Various colours may be fixed upon the fibre in different ways and show then varying fastness properties. These have been criticised upon results obtained by the method of application most usual for the individual dyestuff.

A. WOOL COLOURS.

Method of dyeing.

The letters contained in the first column signify the method of dyeing:

| | |
|-----|--|
| N | dyed in a neutral or just slightly acid (acetic acid) bath (used for Basic colours); |
| SE | died in a weak Acetic acid bath (Dianil colours); |
| ES | died in a weak Acetic acid bath and exhausted with Sulphuric acid; |
| E | died in an Acetic acid bath (Eosines); |
| S | died in a Sulphuric acid bath (usual method of application of all Acid colours); |
| Alk | died in an alkaline bath and developed with acid; |
| Cr | died in an acid bath and developed with Bichrome; |
| Fl | died in an acid bath and developed with Fluoride of Chrome; |
| K | died in an acid bath and developed with Sulphate of Copper; |
| CrK | died in an acid bath and developed with Bluestone and Bichrome; |
| SB | died on Sulphur Mordant; |
| CrV | died on Chrome mordant; |
| AlV | died on Alum mordant; |
| HK | died in the Hydrosulphite vat. |

EQUALISING.

In order to judge the suitability of colours for fancy and full shades, also for different qualities of cloth, as to their equalising easily or with difficulty, in an acid bath, the different figures represent:

1. Colours equalise on all classes of material in light shades, and in fresh baths.

2. Colours equalise in medium shades at the boil; small additions may be made when dyeing in old baths.

3. Colours equalise in medium shades in old baths at the boil, but are not suitable for delicate shades.

4. Colours equalise in dark shades at the boil, but a weaker acid bath and a lower temperature are required when entering goods which equalise with difficulty.

5. Colours do not equalise well; additions must not be made at the boil; goods which equalise with difficulty e. g. Cashmere, are not dyed through.

Several colours which do not equalise well when dyed in the ordinary manner dye perfectly level when exercising certain precautions. The figures given in our tables refer to the ordinary dyeing method with Sulphuric acid.

Affinity for Cotton and Silk.

a) for Cotton.

1. Colours do not stain cotton even in dark shades.

2. Colours stain cotton only slightly in dark shades.

3. Colours stain cotton considerably in dark shades, but do not affect it in light shades; a surplus of acid decreases the affinity for cotton.

4. Colours stain cotton noticeably in light shades.

5. Colours stain cotton very considerably; they dye wool and cotton equally well in a neutral bath (half-wool dyeing). Owing to the great affinity to the vegetable fibre, these colours are used for dyeing effects in an acid bath.

b) for Silk.

1. Colours do not stain silk.

2. Colours do not stain silk in light shades and only slightly in dark shades; in the latter case they can be easily cleaned by passing them through a cleansing bath.

3. Colours stain silk considerably and cannot be cleared in a cleansing bath, even in light shades.

4. Colours dye wool and silk equally well, and can be used for dyeing wool-silk material.

5. Colours dye silk more easily than wool; they may be used to shade up colours showing figure 4 or in combination with colours showing figures 1 and 2 for two-coloured (shot) effects.

Fastness to Rubbing.

The cloth, which has not been earthed, is rubbed vigorously with a piece of white calico.

1. Colours which are perfectly fast to rubbing.

2. Colours which are fairly fast to rubbing.

3. Colours which rub noticeably in deep shades.

4. Colours which rub noticeably in medium shades.

5. Colours which rub considerably even in light shades.

Fastness to Light.

The dyed patterns were exposed for one month, in summer, to the atmospheric influences, and the apparatus placed facing south. The change noticeable after 3, 7, 14 and 30 days was then registered.

1. No noticeable change after 1 month's exposure.
2. Only slight change of shade or slight loss of depth after 1 month.
3. More conspicuous change of shade and depth after 1 month, change already noticeable after 14 days.
4. Considerable change and loss of depth after 14 days.
5. Considerable change and loss of depth after 3—7 days. Colour disappears almost entirely after 1 month.

Fastness to Dry Steam.

The figures denote the effect of dry steam on the shade.

1. No change of shade.
2. Slight change of shade or loss of depth.
3. Noticeable change of shade or loss of depth.
4. Considerable change.
5. Entirely destroyed.

Carbonising.

The dyed patterns were carbonised with Sulphuric acid (4.5° Tw.) at 176° F. and then neutralised with Soda.

1. No change.
2. Slight change
3. More noticeable change.
4. Considerable change when carbonised with Sulphuric acid, but suitable for carbonisation with weaker ingredients.
5. Great change, even when employing weak carbonising agents.

Fastness to Stoving.

The dyed hanks were plaited with white wool and cotton yarn, the plait then soaped, hydroextracted and stoved for 12 hours in a sulphur stove. The two columns under this heading refer to:

- | a) Change of shade. | b) Bleeding into white. |
|-------------------------|-------------------------------------|
| 1. No change. | 1. Colour does not bleed. |
| 2. Slight change. | 2. Colour bleeds slightly. |
| 3. Noticeable change. | 3. Colour bleeds noticeably. |
| 4. Considerable change. | 4. Colour bleeds considerably. |
| 5. Entire change. | 5. Colour bleeds very considerably. |

Fastness to Water.

The dyed yarns were plaited with white wool and cotton and then boiled for 1 hour in calcareous water, also immersed for 12 hours in cold water. These tests are necessary to judge the suitability of the colours for milling in hot and cold water, also for wet steaming.

The figures refer in this case to the bleeding into white; the change of shade, which is fairly general in this instance, has not been considered.

1. Colour does not bleed in boiling water.
2. Colour bleeds slightly in boiling water.
3. Colour does not bleed in cold water even in deep shades.
4. Colour does not bleed in cold water in light shades.
5. Colour bleeds considerably in cold water.

Fastness to Washing.

The patterns were treated for $\frac{1}{2}$ of an hour at 140° and 212° F. with alkaline soap solution (2 parts Soap and $\frac{1}{2}$ part Solvay Soda per 1000 parts water).

1. Colour withstands boiling soap without noticeable change.
2. Colour changes noticeably in boiling soap.
3. Colour withstands soaping at 60° C. without noticeable change.
4. Colour loses considerably in depth at 60° C.
5. Colour is almost entirely stripped at 60° C.

Fastness to Soda.

In order to test the resistance to strong scouring, the yarns were plaited with white cotton and wool and the plaits immersed for 6 hours in Soda solution of 3° Tw. The two columns under this heading refer to:

- | | |
|-------------------------|-------------------------------------|
| a) Change of shade | b) Bleeding into white |
| 1. No change. | 1. Colour does not bleed. |
| 2. Slight change. | 2. Colour bleeds slightly. |
| 3. Noticeable change. | 3. Colour bleeds noticeably. |
| 4. Considerable change. | 4. Colour bleeds considerably. |
| 5. Stripped entirely. | 5. Colour bleeds very considerably. |

Fastness to Milling.

The fastness to milling was tested by milling by hand plaits which contained the dyed yarn together with white cotton and wool yarn, firstly with alkaline soap solution and secondly with neutral soap. Moreover, the fastness to Soda and Water, also the results of practical trials on a large scale, were taken into consideration in compiling these figures which refer to:

- | | |
|--|---|
| a) Change of shade. | b) Bleeding into white. |
| 1. No change even when milled very severely. | 1. Colour does not bleed when milled very severely. |
| 2. No change when milled in the ordinary manner. (Buckskin milling.) | 2. Colour does not bleed when milled ordinarily. |
| 3. No noticeable change when milled in neutral soap. (Flannels.) | 3. Colour does not bleed when milled or washed in neutral soap. |
| 4. No noticeable change when milled in cold water. | 4. Colour does not bleed when milled in cold water. |
| 5. Not fast to any kind of milling. | 5. Colour bleeds in washing or earthing. |

Fastness to Alkalies.

In order to criticise the fastness to dust and street dirt, two further tests with Soda and Quick Lime were made. These tests are more severe and their results more reliable than the wellknown Ammonia test, for, several colours which are not fast to street dirt, recover their appearance when immersed or spotted with Ammonia, and are therefore often judged too favourably.

a) Soda test.

The patterns were immersed in Soda of 15° Tw., the liquid then squeezed out and the patterns dried without being rinsed.

1. Scarcely noticeable change or loss of depth.
2. Slight, but noticeable change.
3. Considerable change.
4. Very considerable change.
5. Entirely, or almost entirely stripped.

b) Quick Lime test.

The patterns were spotted with newly made Quick Lime paste; this was allowed to dry on the patterns and the lime finally brushed off.

1. No change.
2. Slight change.
3. Noticeable change or loss of depth.
4. Considerable change or loss of depth.
5. Stripped entirely.

| Acid Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali Soda | | Quick time |
|--------------------------|------------------|------|------------|------|-----------------|------|---------------------|------|-------------------|------|-----------------------------|------|-------------|------|------------------------|------|---------------------|------|-------------------------|------|------------------------|------|-------------------------------|------|------------|
| | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| Choline Yellow O . . . | S | 1 | 2 | 3-4 | 2 | 3-4 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Naphthol Yellow S . . . | S | 1-2 | 1 | 2 | 1-2 | 4-5 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Flavazine 3GL | S | 3 | 1 | 2-3 | 1 | 2 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Flavazine L | S | 2 | 1-2 | 3 | 1-2 | 2 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Flavazine S | S | 2 | 1-2 | 3 | 1-2 | 2-3 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Flavazine T | S | 3 | 1 | 2 | 1 | 2-3 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Milling Yellow O . . . | E | 5 | 2 | 2-3 | 1-2 | 2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Dianil Pure Yellow HS . | SE | 5 | 5 | 3 | 3 | 4 | 3 | 2-3 | 2-3 | 2-3 | 1 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 |
| Dianil Yellow 3G . . . | SE | 4 | 5 | 3 | 2-3 | 4 | 2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Cresotine Yellow G . . . | SE | 5 | 5 | 3 | 3 | 2 | 1-2 | 3 | 2 | 1-2 | 3 | 2 | 1-2 | 3 | 2 | 1-2 | 3 | 2 | 1-2 | 3 | 2 | 1-2 | 3 | 2 | 1-2 |
| Oxydianil Yellow G . . . | SE | 4-5 | 5 | 4 | 3-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Oxydianil Yellow O . . . | SE | 4-5 | 5 | 4 | 3 | 1 | 1-2 | 1 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Aurophenine O | SE | 5 | 4-5 | 3 | 3 | 2-3 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Dianil Yellow RR . . . | SE | 4-5 | 5 | 3-4 | 2-3 | 3 | 1-2 | 2-1 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Fast Yellow S | S | 2 | 2-3 | 3 | 1-2 | 3 | 2-3 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2 |

| Acid Dyestuffs | Method of Dyeing | | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | Fastness to Alkali | | |
|-------------------------------|------------------|------|------------|--------------|----------|---------------------|-------------------|--------------------------|-------------|---------------------|----------|-------------------|---------------------|----------|----------------------|----------|---------------------|--------------------|-----|-----|
| | Cotton | Silk | | Change | Bleeding | | | | | Change | Bleeding | | Change | Bleeding | Change | Bleeding | | | | |
| Fast Yellow O | S | 5 | 2 | 3 | 3 | 2 | 3 | 2-3 | 2-3 | 2 | 2-3 | 4 | 4 | 4 | 4 | 4 | 3-4 | 4 | 2-1 | 2-3 |
| Azo Yellow conc | S | 2 | 4 | 3 | 3-4 | 2 | 3-4 | 2 | 1-2 | 1-2 | 3 | 4-5 | 3-4 | 3-2 | 4 | 3 | 3 | 4 | 2-1 | 2 |
| Chrysine G | S | 2 | 3-4 | 2 | 3 | 3 | 2-3 | 3 | 2-3 | 2 | 1-2 | 3-4 | 3 | 3-4 | 4-3 | 2-3 | 4 | 2 | 2-3 | |
| Victoria Yellow conc. | S | 2 | 4-3 | 4 | 3 | 2 | 3 | 2-1 | 2 | 2 | 2 | 4 | 4 | 3 | 4-5 | 3-2 | 4 | 1 | 1-2 | |
| Dianil Orange N | SE | 5 | 5 | 3-4 | 3 | 3 | 3-4 | 1-2 | 3-4 | 2 | 1 | 3-2 | 3 | 2 | 2 | 2 | 2 | 1-2 | 1-2 | |
| Orange No. 4 | S | 2 | 3-4 | 4-3 | 2 | 2 | 3 | 1-2 | 2 | 2 | 2 | 4 | 4 | 3 | 5 | 3 | 4 | 1 | 1-2 | |
| Orange G | S | 2 | 3 | 3 | 1 | 2-1 | 2-3 | 1-2 | 1 | 2-1 | 2 | 4 | 4 | 4 | 4 | 5 | 3-4 | 5 | 1-2 | |
| Orange No. 2 | S | 2 | 3 | 4 | 2-1 | 3-2 | 1 | 1 | 1 | 1-2 | 2 | 4 | 4 | 3 | 5 | 3 | 4 | 2-1 | 2 | |
| Orange R | S | 2-3 | 3 | 4 | 2-1 | 3-2 | 1 | 1 | 1 | 1-2 | 2 | 4 | 4 | 4 | 4 | 5 | 3-4 | 4-5 | 2 | 2-3 |
| Orange RR | S | 2-3 | 3-4 | 4 | 2-1 | 3-2 | 1 | 1 | 1 | 1-2 | 2 | 4 | 4 | 4 | 4-3 | 5 | 3-4 | 4 | 2 | 2 |
| Brilliant Orange G | S | 2 | 3-4 | 3-4 | 1-2 | 2-3 | 1 | 1-2 | 1-2 | 1-2 | 2-3 | 4 | 4-3 | 3-4 | 5 | 3 | 4-5 | 1-2 | 2 | |
| Brilliant Orange O | S | 2 | 3-4 | 3-4 | 1-2 | 2-3 | 1 | 1-2 | 1-2 | 1-2 | 2-3 | 4 | 4-3 | 3 | 5 | 3 | 4-5 | 2-1 | 2 | |
| Brilliant Orange R | S | 2-3 | 3-4 | 4-3 | 2 | 3-2 | 1-2 | 1 | 1 | 1-2 | 2 | 4 | 4-3 | 3-2 | 5 | 3 | 4-5 | 1-2 | 2 | |
| Victoria Scarlet 3G | S | 3-4 | 2-3 | 3-2 | 1-2 | 2-3 | 1-2 | 1-2 | 1-2 | 2-3 | 3 | 4 | 4 | 4 | 4-5 | 3-4 | 4 | 2 | 3 | |
| Victoria Scarlet G | S | 3-4 | 2 | 2-3 | 1-2 | 2-3 | 1-2 | 1-2 | 1-2 | 3 | 3 | 4 | 4 | 4 | 4 | 3-4 | 4-5 | 2 | 3 | |

| Acid Dyestuffs | | Method of Dyeing | | Equalising | | Affinity for | Fastness to Rubbing | | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Washing | | Change | Bleeding | Fastness to Scouring | Change | Bleeding | Fastness to Milling | Fastness to Soda Alkali | Quick time |
|--------------------------------|---|------------------|---|------------|------|-----------------|---------------------|-----|-------------------|-----------------------------|-------------|------------------------|---|---------------------|-----|--------|----------|----------------------|--------|----------|---------------------|-------------------------|------------|
| | | | | Cotton | Silk | | | | | | | | | | | | | | | | | | |
| Victoria Scarlet R | . | . | . | 4-3 | 2 | 3-2 | 1 | 2-3 | 1-2 | 1-2 | 1-2 | 3-4 | 3 | 4-3 | 4 | 4 | 3-4 | 4-5 | 2 | 3 | | | |
| Victoria Scarlet RR | . | . | . | S | 4 | 2 | 2-3 | 1 | 2-3 | 1-2 | 1-2 | 4 | 3 | 3-4 | 4-3 | 4 | 3-4 | 4 | 2 | 3-4 | | | |
| Victoria Scarlet 3R | . | . | . | S | 4 | 1-2 | 2 | 1 | 2-3 | 1-2 | 1-2 | 5 | 3 | 3 | 4-3 | 4-5 | 3-4 | 4 | 2 | 3-4 | | | |
| Victoria Scarlet 4R | . | . | . | S | 4 | 1 | 2 | 1 | 2-3 | 1-2 | 1-2 | 5 | 3 | 3 | 4-3 | 4-5 | 3-4 | 4 | 2 | 3-4 | | | |
| Victoria Scarlet 6R | . | . | . | S | 4 | 1 | 2-1 | 1 | 2-3 | 1-2 | 1-2 | 5 | 3 | 3 | 4-3 | 4-5 | 3-4 | 4 | 2-3 | 3-4 | | | |
| Scarlet G | . | . | . | S | 3 | 2-3 | 3 | 1 | 3 | 1-2 | 1 | 1-2 | 2 | 3-4 | 4 | 3 | 5 | 3 | 4 | 1-2 | 2 | | |
| Scarlet R | . | . | . | S | 3 | 2 | 3 | 1 | 3 | 1 | 1 | 1-2 | 2 | 3-4 | 4 | 3 | 5 | 3 | 4 | 1-2 | 2 | | |
| Scarlet RR | . | . | . | S | 3 | 2 | 3 | 1 | 3 | 1 | 1 | 1-2 | 2 | 3 | 4 | 3 | 5 | 3 | 4 | 1-2 | 2 | | |
| Brilliant Crocine R | . | . | . | S | 4 | 2-3 | 4 | 1-2 | 2 | 2-3 | 2 | 3 | 2 | 3-4 | 3-4 | 3 | 4 | 3 | 4 | 2 | 2-3 | | |
| Brilliant Crocine yellow shade | | | | S | 4 | 2-3 | 4 | 1 | 2 | 2 | 2-1 | 4 | 2 | 3 | 3 | 3 | 4 | 3 | 3-4 | 2 | 2-3 | | |
| Brilliant Crocine blue shade | | | | S | 4 | 2-3 | 4 | 1-2 | 2 | 2 | 2-1 | 4 | 2 | 3 | 3 | 3 | 4 | 3 | 3-4 | 2 | 2 | | |
| Brilliant Crocine 3B | . | . | . | S | 4 | 2-3 | 4 | 1-2 | 2 | 2-3 | 2-1 | 4 | 2 | 3 | 3 | 3 | 4-5 | 3 | 4 | 2-3 | 2-3 | | |
| New Coccine O | . | . | . | S | 4 | 2 | 1-2 | 1 | 2-3 | 2 | 1-2 | 5 | 3 | 3 | 4-3 | 4-5 | 3-4 | 3-4 | 4 | 2 | 3-4 | | |
| Nassovia Scarlet O | . | . | . | S | 3-4 | 2-3 | 3 | 1 | 2-3 | 1 | 1-2 | 1 | 2 | 3 | 4-3 | 4 | 4 | 3-4 | 3-4 | 1-2 | 3 | | |
| Milling Scarlet 4R conc. | . | . | . | E | 5 | 2 | 4 | 1 | 3-4 | 1 | 1 | 2-3 | 1 | 2 | 2 | 2-1 | 2 | 1-2 | 2 | 1 | 1-2 | | |

| Acid Dyestuffs | Method of Dyeing | Equalising | | Affinity for | Fastness to Rubbing | | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | Fastness to Alkali | | |
|----------------------------------|------------------|------------|------|-----------------|---------------------|----------|-------------------|-----------------------------|-------------|------------------------|----------|---------------------|----------|-------------------------|-----|---------------------------|--------------------------|-----|-----|
| | | Cotton | Silk | | Change | Bleeding | | | | Change | Bleeding | Change | Bleeding | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Scarlet 3R | S | 3 | 1-2 | 3 | 1 | 3 | 1 | 1 | 1 | 1-2 | 2 | 3 | 4 | 3 | 5 | 3 | 4 | 1-2 | 2 |
| Scarlet 4R | S | 3 | 1-2 | 3 | 1 | 3 | 1 | 1 | 1 | 1-2 | 2 | 3 | 4 | 3 | 5 | 3 | 4 | 1-2 | 2 |
| Scarlet 5R | S | 4 | 1 | 3 | 1-2 | 2-3 | 1-2 | 2 | 2 | 5 | 2 | 3 | 4 | 3-4 | 5 | 3 | 4 | 3 | 3 |
| Scarlet 6R | S | 4 | 1 | 2 | 1 | 3-2 | 1 | 1 | 1 | 5 | 2 | 3 | 4 | 4 | 4 | 3 | 4 | 3-2 | 3-4 |
| Scarlet 6R cryst. | S | 4-3 | 1-2 | 3 | 1 | 3 | 1 | 1-2 | 1-2 | 2 | 2 | 3 | 4 | 3-4 | 5 | 3 | 4 | 2 | 3 |
| Scarlet B extra | S | 4 | 3-4 | 4 | 2 | 2-3 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2-3 | 4 | 2-3 | 3-4 | 2-3 | 2 |
| Fast Red O | S | 4 | 4-3 | 4 | 2 | 4-3 | 1 | 1-2 | 1-2 | 2-3 | 2 | 3-4 | 3-4 | 3 | 4 | 3 | 3-4 | 2 | 2-3 |
| Fast Red S | S | 4 | 2-3 | 3 | 1-2 | 4-3 | 1 | 1-2 | 1-2 | 3-2 | 2 | 3 | 4 | 4 | 4 | 3 | 4-3 | 2-3 | 3 |
| Brilliant Crimson O | S | 4-3 | 2 | 3 | 1 | 2-3 | 1-2 | 1-2 | 1-2 | 2 | 2 | 3 | 4 | 4 | 4 | 3-4 | 4 | 3 | 2 |
| Naphthol Red O | S | 4 | 1 | 2 | 1 | 3-2 | 2 | 2 | 2 | 2 | 1-2 | 3 | 4-3 | 3-4 | 4 | 3-4 | 4 | 3 | 2-3 |
| Victoria Rubine O | S | 4 | 1 | 2 | 1 | 3-2 | 2 | 2 | 2 | 2 | 2 | 3 | 4-3 | 3-4 | 4 | 3-4 | 4 | 3 | 2-3 |
| Dianil Red R | SE | 5 | 5 | 3-4 | 2-3 | 3 | 1 | 4 | 4 | 4 | 1-2 | 3 | 3-2 | 2 | 2 | 2 | 2-1 | 1 | 1-2 |
| Dianil Red 4B | SE | 5 | 5 | 3-4 | 2 | 3 | 1 | 4 | 4 | 3 | 1 | 3 | 3 | 2 | 2-1 | 2 | 2-1 | 1 | 1-2 |
| Delta Purpurine 5B | SE | 5 | 5 | 3-4 | 2 | 3 | 1 | 4 | 4 | 3 | 1 | 3 | 3 | 2 | 1-2 | 2 | 2-1 | 1 | 1-2 |
| Brilliant Dianil Red R | SE | 5 | 5 | 3 | 2 | 3 | 1 | 4 | 4 | 2-3 | 1-2 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1-2 |

| Acid Dyestuffs | Method of Dyeing | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Washing | Fastness to Scouring | | Change | Bleeding | Fastness to Milling | Fastness to Alkali | Quick lime |
|----------------------|------------------|------------|--------------|------|---------------------|-------------------|--------------------------|-------------|---------------------|----------|---------------------|----------------------|-----|--------|----------|---------------------|--------------------|------------|
| | | | Cotton | Silk | | | | | | | | | | | | | | |
| | | | | | | | | | Change | Bleeding | | | | | | | | |
| Dianil Fast Red PH | SE | 5 | 5 | 4-3 | 3 | 2-3 | 1 | 3 | 2 | 1-2 | 3 | 3 | 2 | 2-3 | 2 | 2 | 1 | 1-2 |
| Dianil Red 10B | SE | 5 | 5 | 3-4 | 2 | 4 | 1-2 | 2-3 | 4-5 | 1 | 3 | 3 | 2 | 2-3 | 2 | 2-1 | 1 | 1-2 |
| Dianil Crimson B. | SE | 5 | 5 | 2 | 1-2 | 2 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 2-3 | 2 | 2-3 | 1 | 1-2 |
| Claret Red G. | S | 4 | 2 | 3 | 1-2 | 3 | 2 | 1-2 | 2 | 2 | 3 | 4 | 3 | 4 | 3-4 | 3-4 | 3 | 2-3 |
| Claret Red B. | S | 4 | 2 | 3 | 1-2 | 3 | 2-3 | 1-2 | 2 | 2-1 | 3 | 4 | 3 | 4 | 3-4 | 3-4 | 3 | 2-3 |
| Claret Red R extra | S | 4 | 3 | 3 | 1-2 | 3 | 2 | 1-2 | 2 | 2-1 | 3 | 4 | 3 | 4 | 3-4 | 3-4 | 3 | 2-3 |
| Cloth Red O | S | 4-5 | 3-4 | 3-4 | 2 | 2 | 2 | 2 | 3 | 1-2 | 2-3 | 3 | 4-3 | 3-4 | 3-2 | 3 | 3 | 2 |
| Dianil Claret Red G. | SE | 5 | 5 | 3 | 3 | 4 | 1 | 2 | 3 | 1-2 | 3 | 3 | 2 | 3 | 2 | 2-3 | 2 | 1-2 |
| Dianil Claret Red B. | SE | 5 | 5 | 3-4 | 3 | 4 | 1 | 3 | 3 | 1-2 | 3 | 4 | 2 | 3-2 | 2 | 2-3 | 2 | 1-2 |
| Dianil Violet H. | SE | 5 | 5 | 3 | 3 | 2-3 | 1 | 3 | 3 | 1-2 | 3 | 3 | 2 | 2-3 | 2 | 2 | 1-2 | 1-2 |
| Dianil Brown 3GO | SE | 5 | 5 | 3 | 3 | 4-3 | 2-3 | 3-4 | 2-3 | 2 | 3-4 | 3-4 | 2 | 4 | 2 | 3-4 | 2 | 2 |
| Fast Brown O. | S | 4 | 3 | 3 | 2 | 3-4 | 1-2 | 1-2 | 2 | 2 | 4 | 4-3 | 3 | 5 | 3 | 4 | 1-2 | 2 |
| Fast Brown L. | S | 4 | 3-4 | 3-4 | 2 | 3-4 | 2 | 2 | 2-3 | 2 | 4 | 4-3 | 3 | 5 | 3 | 4 | 1-2 | 2 |
| Dianil Brown G. | SE | 5 | 5 | 3 | 3 | 4-3 | 2-3 | 2-3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2-3 | 2 | 1-2 |
| Dianil Fast Brown B. | SE | 5 | 5 | 3 | 3 | 4-3 | 1-2 | 3 | 2-3 | 2-3 | 3 | 3 | 2 | 4 | 2 | 3 | 2 | 1-2 |

| Acid Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|---------------------------|------------------|-----|------------|-----|--------------|------|---------------------|---|-------------------|-----|--------------------------|-----|-------------|----------|---------------------|-----|---------------------|----------|----------------------|--------|---------------------|------|--------------------|-----|
| | | | | | Cotton | Silk | | | | | | | Change | Bleeding | | | Change | Bleeding | | Change | Bleeding | Soda | Quick lime | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Dianil Brown MH . . . | SE | 1-2 | 5 | 3 | 3 | 3 | 3 | 3 | 3-4 | 1 | 2 | 1-2 | 1-2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2-3 | 1-2 | 1-2 |
| Azo Acid Brown R conc. . | S | 1-2 | 5 | 3 | 1 | 3 | 2 | 2 | 3-4 | 2 | 2-1 | 1-2 | 1-2 | 2 | 4-3 | 4 | 5 | 4 | 4 | 5 | 4 | 3-4 | 4 | 4 |
| Azo Acid Red B . . . | S | 2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 2-3 | 2 | 2-3 | 1-2 | 1-2 | 1-2 | 3-4 | 4 | 4-5 | 4 | 4 | 4-5 | 4 | 4-3 | 2 | 3-4 |
| Amido Brilliant Red G . . | S | 2 | 1 | 2-3 | 1 | 2-3 | 1 | 1 | 2 | 1 | 2-1 | 1-2 | 1-2 | 1-2 | 3-4 | 4-3 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3-4 |
| Amido Naphthol Red G . . | S | 2 | 1 | 2-3 | 1 | 2-3 | 1 | 1 | 2 | 1-2 | 2-3 | 2-1 | 2-1 | 1-2 | 4-3 | 4-3 | 4-5 | 4 | 4 | 4-5 | 4 | 3-4 | 2 | 3 |
| Amido Naphthol Red 2B . | S | 2 | 1 | 2-3 | 1 | 2-3 | 1 | 1 | 2-3 | 1-2 | 2 | 1-2 | 1-2 | 1-2 | 4-3 | 4-3 | 4 | 4 | 4 | 4 | 3-4 | 2 | 3 | |
| Amido Naphthol Red 6B . | S | 2 | 1 | 2-3 | 1 | 2-3 | 1 | 1 | 3-2 | 1-2 | 2-1 | 2-1 | 1-2 | 1-2 | 3-4 | 4-3 | 4 | 4 | 4 | 4 | 3-4 | 2 | 3-4 | |
| Azo Acid Carmine B . . . | S | 3 | 3 | 1 | 1-2 | 1 | 1 | 2 | 2 | 2-3 | 2-1 | 2-1 | 1-2 | 1 | 3-2 | 3 | 3 | 3 | 3 | 3 | 3-2 | 3 | 2 | |
| Azo Brilliant Carmine B . | S | 2-3 | 1 | 2-3 | 1 | 2-3 | 1 | 2 | 2 | 2-3 | 2-1 | 2-1 | 1-2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3-2 | 3 | 2 | |
| Azo Acid Magenta G . . . | S | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2-3 | 2 | 1-2 | 1-2 | 1-2 | 2 | 3-4 | 4-3 | 4 | 4 | 4 | 4 | 3-4 | 2-3 | 3 | |
| Azo Acid Magenta B . . . | S | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2-3 | 2 | 1-2 | 1-2 | 1-2 | 2 | 3-4 | 4-3 | 4 | 4 | 4 | 4 | 3-4 | 2-3 | 3 | |
| Archil Substitute G . . . | S | 2 | 2 | 2 | 2 | 3 | 1-2 | 2 | 2-3 | 2 | 2 | 2 | 1-2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | |
| Chromotrope 2R . . . | S | 2 | 1 | 3 | 1 | 3 | 1 | 1 | 2 | 2 | 1-2 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3-4 | 4 | |
| Chromotrope 6B . . . | S | 2-3 | 1-2 | 3 | 1-2 | 3 | 1 | 1 | 2-3 | 2 | 2-3 | 2-3 | 1-2 | 2 | 3-4 | 4 | 4-5 | 3 | 3 | 4 | 4 | 3 | 4 | |
| Chromotrope 8B . . . | S | 4 | 1 | 2 | 1 | 2 | 1 | 1 | 3-2 | 2 | 1-2 | 1-2 | 1 | 1-2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | |
| Chromotrope 10B . . . | S | 4 | 2 | 3 | 1 | 3 | 1 | 1 | 3-2 | 2-1 | 1-2 | 1-2 | 1 | 1-2 | 3 | 4 | 3-4 | 3 | 3 | 3-4 | 4 | 3-4 | 3-4 | |
| Victoria Violet RL . . . | S | 3-2 | 1-2 | 2 | 1-2 | 2 | 1 | 1 | 3-2 | 2 | 1-2 | 1-2 | 4-5 | 2 | 3 | 3-4 | 3 | 3 | 3 | 3 | 3 | 2-3 | 3 | |
| Victoria Violet 4BS . . . | S | 3-2 | 1 | 2 | 1 | 2 | 1 | 1 | 4 | 2 | 1-2 | 1-2 | 1-2 | 1 | 3-2 | 3-2 | 2-3 | 2-3 | 2 | 2 | 3 | 3-4 | 3 | |

| Acid Dyestuffs | Method of Dyeing | | Equalising | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Water | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|-----------------------------------|------------------|---|------------|--------------|------|---------------------|-----|-------------------|-----|--------------------------|-----|-------------|-----|---------------------|----------|-------------------|-----|---------------------|-----|----------------------|----------|---------------------|----------|--------------------|--|
| | S | S | | Cotton | Silk | S | S | S | S | S | S | S | S | Change | Bleeding | S | S | S | S | Change | Bleeding | Change | Bleeding | Soda | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| Victoria Violet 4BSL . . . | 2-3 | | | 1 | 3 | 1-2 | 1-2 | 3 | 1-2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4-3 | 3-4 | 4 | |
| Victoria Violet SBS . . . | 3-2 | | | 2 | 2-3 | 1 | 1-2 | 4 | 2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 3 | 3-2 | 3-2 | 2-3 | 3-2 | 3 | 3 | 3 | 2-3 | |
| Azo Acid Blue B . . . | 2-3 | | | 2 | 2 | 2 | 1 | 4 | 2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 3 | 3-2 | 3-2 | 2-3 | 3 | 3 | 3 | 3 | 2-3 | |
| Azo Acid Blue 3B conc. . . | 4 | | | 3 | 3 | 2 | 3-4 | 2 | 3-4 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 3-2 | 2-3 | 3 | 3 | 3 | 3-2 | 3 | 3 | 2-3 | |
| Naphtalene Blue BN conc. . . | 3 | | | 3 | 3 | 1-2 | 3-4 | 2-3 | 2 | 2 | 2 | 2 | 1-2 | 1-2 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue B . . . | 3 | | | 3 | 3 | 1-2 | 3-4 | 3-2 | 3-2 | 3-2 | 3-2 | 3-2 | 2-3 | 1-2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue V . . . | 3 | | | 3 | 3 | 1-2 | 3-4 | 3-2 | 3-2 | 3-2 | 3-2 | 3-2 | 2-3 | 1-2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue BH . . . | 3 | | | 3 | 3 | 2-1 | 3-4 | 3-2 | 3-2 | 2-1 | 2-1 | 2 | 2-3 | 2-1 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue DN extra . . | 3-2 | | | 2 | 3-4 | 1-2 | 3-4 | 2 | 2 | 2 | 2 | 2 | 2 | 2-1 | 3-4 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue LR . . . | 3 | | | 1-2 | 3 | 1-2 | 4-3 | 2 | 2 | 2 | 2 | 2 | 2-3 | 2 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue B extra . . | 3 | | | 1-2 | 3 | 1-2 | 4-3 | 2-3 | 2 | 2 | 2 | 2 | 2-3 | 1-2 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | 3 | 2-3 | |
| Naphtalene Blue R . . . | 3 | | | 2 | 3 | 1-2 | 3-4 | 2-3 | 2 | 2 | 2 | 2 | 2-3 | 1-2 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Blue J . . . | 3 | | | 2 | 3 | 1-2 | 4-3 | 2-3 | 2 | 2 | 2 | 2 | 3-2 | 1-2 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Amido Blue B . . . | 3-2 | | | 1 | 3 | 1-2 | 3-2 | 2-1 | 1-2 | 4 | 2-1 | 3-2 | 4 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Amido Blue GR . . . | 3-2 | | | 1 | 3 | 1-2 | 3-2 | 2-1 | 1-2 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Amido Blue LE . . . | 3-2 | | | 1 | 3 | 1-2 | 3-2 | 2-1 | 1-2 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Amido Blue GS . . . | 3-2 | | | 1 | 3 | 1-2 | 3-2 | 2-1 | 1-2 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Patent Marine Blue LE . . . | 2-3 | | | 1 | 3 | 1-2 | 3 | 2 | 1-2 | 2 | 2 | 2 | 2 | 2 | 4-3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2-3 | |
| Naphtalene Dark Blue EG extra . . | 2-3 | | | 1-2 | 3 | 1-2 | 3-2 | 2-3 | 2 | 2 | 2 | 2 | 2 | 2 | 3-4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2-3 | |

| Acid Dyestuffs | Method of Dyeing | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|--------------------------|------------------|---|--------------|------|---------------------|-----|-------------------|-----|--------------------------|-----|-------------|-----|---------------------|----------|---------------------|-----|----------------------|----------|---------------------|----------|--------------------|-----|
| | Equalising | | Cotton | Silk | | | | | | | | | Change | Bleeding | | | Change | Bleeding | Change | Bleeding | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| Fast Dark Blue B extra | 4-5 | E | 1-2 | 2 | 1-2 | 3-4 | 2 | 1 | 3 | 1 | 2-3 | 3-4 | 3 | 2-3 | 3-4 | 3 | 2-3 | 3-4 | 3 | 2-3 | 2 | 2 |
| Azo Acid Black R | 2-3 | S | 2-3 | 3 | 1 | 4-5 | 1-2 | 2 | 2 | 2 | 2-3 | 4 | 2 | 2-3 | 4 | 4 | 4 | 4-5 | 3-4 | 4 | 3 | 3 |
| Azo Acid Black B | 2-3 | S | 2-3 | 3 | 1 | 4-5 | 1-2 | 2 | 2 | 2 | 2-3 | 4 | 2 | 2-3 | 4 | 4 | 4 | 4-5 | 3-4 | 4 | 3 | 3 |
| Azo Acid Black G | 2-3 | S | 2-3 | 3 | 1 | 4-5 | 2 | 2 | 2-3 | 2 | 2-3 | 4 | 2 | 2-3 | 4 | 4 | 4 | 4-5 | 3-4 | 4 | 3 | 3 |
| Azo Acid Black 3BL | 3 | S | 2-3 | 3 | 1 | 4-3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 3-4 | 4 | 3-4 | 4 | 2-3 | 2-3 |
| Azo Acid Black BL | 3 | S | 2-3 | 3 | 1 | 4-3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1-2 | 3 | 4 | 3-4 | 4 | 3-4 | 4 | 2-3 | 2-3 |
| Azo Acid Black TL conc. | 3 | S | 2 | 3 | 1-2 | 4 | 2 | 2 | 2 | 2 | 2 | 4 | 2 | 1-2 | 4 | 4 | 4-5 | 3-4 | 4 | 3-2 | 2-3 | 2-3 |
| Azo Acid Black 3BLOO | 3 | S | 2 | 3-2 | 1-2 | 4-3 | 2 | 2 | 2-1 | 1-2 | 3-1 | 4-3 | 2-1 | 1-2 | 3-1 | 4-3 | 3-4 | 4 | 3-4 | 4 | 2-3 | 2-3 |
| Azo Acid Black 3BL extra | 3 | S | 2 | 3 | 1-2 | 4-3 | 2-1 | 2 | 2-1 | 1-2 | 3-1 | 4-3 | 2-1 | 1-2 | 3-1 | 4-3 | 3-4 | 4 | 3-4 | 4 | 2-3 | 3-2 |
| Azo Acid Black TL extra | 3 | S | 2 | 3 | 1-2 | 4 | 2 | 2 | 2 | 1-2 | 4-3 | 4 | 2 | 1-2 | 4-3 | 3-1 | 4-5 | 3-4 | 4 | 3-2 | 3-2 | 3-2 |
| Azo Acid Black KL extra | 3-4 | S | 2-3 | 3 | 1-2 | 3-2 | 2 | 2-1 | 1-2 | 1-2 | 3 | 3-4 | 3-4 | 1-2 | 3 | 3-4 | 4-5 | 3-4 | 4-3 | 2-1 | 1-2 | 1-2 |
| Azo Acid Black KRL extra | 3-4 | S | 2-3 | 3 | 1-2 | 3-2 | 2 | 2-1 | 1-2 | 1-2 | 3 | 3-4 | 3-4 | 1-2 | 3 | 3-4 | 4-5 | 3-4 | 4-3 | 2-1 | 1-2 | 1-2 |
| Azo Acid Black 3BN | 3 | S | 2-3 | 3 | 1-2 | 4-3 | 2 | 2 | 2 | 1-2 | 3 | 4 | 2 | 1-2 | 3 | 4 | 3-4 | 4 | 3-4 | 4 | 2-3 | 3-2 |
| Azo Acid Black TN | 3 | S | 2 | 3 | 1-2 | 4 | 2 | 2 | 2 | 1-2 | 4 | 4 | 2 | 1-2 | 4 | 4 | 4-5 | 3-4 | 4 | 3-2 | 3-2 | 3-2 |

| Acid Dyestuffs | Method of Dyeing | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | Fastness to Alkali |
|----------------------------------|------------------|------------|-----------------|------|---------------------|-------------------|-----------------------------|-------------|------------------------|----------|-------------------|---------------------|----------|-------------------------|-----|---------------------------|--------------------------|
| | | | Cotton | Silk | | | | | Change | Bleeding | | Change | Bleeding | | | | |
| | | | | | | | | | | | | | | | | | |
| Amido Black A | S | 3-4 | 2 | 3 | 1-2 | 2-3 | 2 | 1 | 2-3 | 1-2 | 3 | 2-3 | 2-3 | 4 | 3 | 3-4 | 2 |
| Amido Black AT | S | 3-4 | 2 | 3 | 1-2 | 2-3 | 2 | 1 | 3 | 1-2 | 3 | 2-3 | 2-3 | 4 | 3 | 3-4 | 2 |
| Amido Black 10BO | S | 4 | 2-1 | 3 | 1-2 | 3-2 | 1-2 | 1 | 1-2 | 2 | 3 | 3 | 3 | 4 | 3 | 4 | 2 |
| Amido Black 2B | S | 4-3 | 1-2 | 3 | 1-2 | 3 | 2-3 | 1 | 3-4 | 2 | 3 | 3 | 3-2 | 4 | 3 | 3-4 | 1-2 |
| Amido Black T | S | 4-3 | 2-3 | 3 | 1-2 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | 4 | 1-2 |
| Amido Black E | S | 4-3 | 2-3 | 3 | 1-2 | 3 | 2 | 1 | 3-4 | 2 | 3 | 3-4 | 3 | 4 | 3 | 3-4 | 1-2 |
| Amido Black ET conc. | S | 4-3 | 2-3 | 3 | 1-2 | 3 | 3-2 | 1 | 3-4 | 2 | 3 | 3 | 3 | 4 | 3 | 3-4 | 1-2 |
| Amido Naphtol Black S | ES | 5 | 3 | 4-3 | 2 | 3-2 | 3-4 | 1-2 | 3-4 | 1-2 | 3 | 3 | 3 | 3-4 | 3 | 3-4 | 2 |
| Amido Naphtol Black 6B | ES | 5 | 3 | 4-3 | 2 | 3-2 | 3-4 | 2 | 4-3 | 1-2 | 3 | 3 | 3 | 4 | 3 | 4-3 | 1-2 |
| Amido Naphtol Black 4B | ES | 5 | 3 | 4-3 | 2 | 3 | 3-4 | 2 | 4-3 | 1-2 | 3 | 3 | 3 | 4 | 3 | 4-3 | 1-2 |
| Amido Naphtol Black RK | ES | 5 | 3-4 | 4-3 | 2 | 3 | 3-4 | 2 | 4 | 1-2 | 3 | 3 | 3 | 4-5 | 3 | 4 | 1-2 |
| Tolyl Black B | S | 5 | 3 | 3-4 | 2-1 | 2 | 2 | 2 | 5 | 1 | 3 | 2-3 | 2 | 2-3 | 2-1 | 2 | 1 |
| Tolyl Black 2B | S | 5 | 3 | 3-4 | 2-1 | 2 | 2 | 2 | 5 | 1 | 3 | 2-3 | 2 | 2-3 | 2-1 | 2 | 1 |
| Tolyl Black BG | S | 5 | 3-4 | 3-4 | 2-1 | 2-3 | 4 | 3-2 | 5 | 1 | 3 | 2-3 | 2 | 3 | 2 | 3-2 | 2 |
| Alphyl Blue Black O | ES | 4-5 | 3-2 | 4 | 2 | 3 | 4 | 2 | 5 | 2 | 3 | 3 | 2-3 | 3 | 3-2 | 2-3 | 1-2 |
| Alphyl Blue Black OK | ES | 4-5 | 3-2 | 4 | 2 | 3 | 4 | 2 | 5 | 2 | 3-4 | 3-4 | 2-3 | 3 | 3 | 3-4 | 1-2 |
| Silk Wool Black 3B | E | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 4 | 2 | 3-4 | 3 | 2-3 | 3 | 3-2 | 2-3 | 1-2 |
| Carbon Black 3B | S | 5 | 1 | 2-3 | 1 | 2-3 | 1-2 | 1 | 2 | 1 | 3 | 3-4 | 2-3 | 3 | 3 | 3-4 | 2-1 |
| Carbon Black B | S | 5 | 1 | 2-3 | 1 | 2-3 | 1-2 | 1 | 2 | 1 | 3 | 3-4 | 2-3 | 3 | 3 | 3-4 | 1-2 |
| Carbon Black BD | S | 5 | 1 | 2 | 1 | 2-3 | 2 | 2 | 2 | 1 | 3-4 | 3-4 | 3 | 3-4 | 3 | 3-4 | 1-2 |
| Carbon Black T | S | 5 | 1 | 2-3 | 1-2 | 2-3 | 2 | 2 | 2 | 1 | 3-4 | 3-4 | 3 | 3 | 3 | 3-4 | 1 |

| Acid Dyestuffs | Method of Dyeing | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|-----------------------------|------------------|------------|------|--------------|----------|---------------------|---------------------|-------------------|----------|--------------------------|----------|-------------|----------|---------------------|----------|---------------------|----------|----------------------|----------|---------------------|----------|--------------------|------------|
| | | Cotton | Silk | Change | Bleeding | Fastness to Water | Fastness to Washing | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Soda | Quick lime |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Fast Blue O Soluble . . . | ES | 4 | 4 | 4 | 4 | 3-4 | 4 | 4 | 1-2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4-3 | 3 | 2 | 3 | 4 | 3-4 |
| Fast Blue R | ES | 4 | 4 | 4 | 4 | 3-4 | 4 | 4 | 1-2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3-4 |
| Fast Blue 3R | ES | 4 | 4 | 4 | 4 | 3-4 | 4 | 4 | 2-1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3-4 |
| Fast Dark Blue R | ES | 4 | 3-4 | 4 | 2-3 | 3-4 | 2-1 | 1 | 2-1 | 2-1 | 3 | 3-4 | 3 | 2-1 | 2-1 | 3 | 3-4 | 3 | 3 | 2-3 | 2-3 | 2-3 | 2-3 |
| Fast Blue Black O | ES | 4 | 4 | 4 | 3-4 | 4-3 | 1-2 | 1 | 2 | 2-1 | 3-4 | 3-4 | 4 | 2 | 2-1 | 3-4 | 3-4 | 4 | 4-3 | 3 | 3 | 4 | 3-4 |
| Nigrosine No. 1 | ES | 4 | 4 | 4-3 | 3-4 | 4-3 | 2-3 | 2 | 2 | 2-1 | 3-4 | 4 | 4 | 2 | 2-1 | 3-4 | 4 | 4 | 3 | 3 | 3 | 4 | 3-4 |
| Acid Alizarine Grey G . . | ES | 4 | 4 | 4-3 | 2-3 | 2-3 | 2 | 2 | 2 | 1 | 2-3 | 3 | 2 | 2 | 1 | 2-3 | 3 | 2 | 2 | 2 | 2 | 1-2 | 1 |
| Fast Acid Violet A2R . . | S | 2 | 3-4 | 4 | 3 | 2-3 | 2 | 2 | 1-2 | 2 | 3 | 3 | 2-3 | 3 | 2 | 3 | 3 | 2-3 | 3 | 2 | 2 | 2 | 1-2 |
| Fast Acid Violet R . . . | S | 2 | 3-4 | 4 | 3 | 2-3 | 2 | 2 | 1-2 | 2 | 3 | 3 | 2-3 | 3 | 2 | 3 | 3 | 2-3 | 3 | 2 | 2 | 2 | 1-2 |
| Fast Acid Violet B . . . | S | 2 | 3-4 | 4 | 3 | 2-3 | 2-3 | 2 | 2 | 1-2 | 3 | 3 | 2-3 | 3 | 2 | 3 | 3 | 2-3 | 3 | 2 | 2 | 2-3 | 2-1 |
| Milling Blue 2R extra . . | S | 2-3 | 3 | 4 | 3-2 | 3-4 | 1-2 | 1-2 | 1 | 1-2 | 3 | 3 | 2-3 | 3-2 | 3-2 | 3 | 3 | 2-3 | 3-2 | 2-3 | 3-2 | 2 | 2-1 |
| Fast Acid Blue R | ES | 4 | 3 | 4 | 3-2 | 3-2 | 2 | 1-2 | 1 | 1 | 2-3 | 3 | 2 | 2-3 | 2 | 2-3 | 3 | 2 | 2-3 | 2 | 2 | 2 | 1-2 |
| Alizarine Direct Blue B . . | ES | 4-3 | 2 | 3 | 1-2 | 1-2 | 3 | 1 | 1 | 1 | 3-2 | 3-4 | 2-3 | 2-3 | 2-3 | 3-4 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2 | 2-3 |
| Alizarine Direct Green G . | ES | 4 | 1-2 | 2-3 | 2 | 2-1 | 2 | 1 | 1 | 1 | 2 | 3 | 1-2 | 2-3 | 2-3 | 3 | 1-2 | 1-2 | 2-3 | 1-2 | 2-3 | 1-2 | 1-2 |

| Acid Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Washing | Fastness to Scouring | Fastness to Milling | | Fastness to Alkali |
|----------------------------|------------------|-----|------------|-----|-----------------|---------------------|-------------------|-----------------------------|-------------|------------------------|----------|---------------------|-------------------------|------------------------|----------|-----------------------|
| | | | | | | | | | | Change | Bleeding | | | Change | Bleeding | |
| Fast Acid Eosine G . . . | S | 1 | 1 | 1 | 4-3 | 2 | 3 | 1-2 | 1-2 | 1 | 1 | 3-4 | 3-4 | 3 | 3 | 3 |
| Fast Acid Phloxine A . . | S | 1 | 1 | 1 | 4 | 2 | 3 | 1-2 | 1-2 | 1 | 1 | 3-4 | 3 | 2-3 | 3-2 | 3 |
| Fast Acid Magenta G . . | S | 1 | 2 | 4 | 2 | 2 | 2-3 | 2 | 2 | 1-2 | 1 | 3-4 | 2 | 2 | 2-3 | 1-2 |
| Acid Rosamine A . . . | S | 4-3 | 3 | 4 | 3-4 | 2-3 | 2-3 | 2 | 2 | 1-2 | 1-2 | 3-2 | 2-3 | 2-3 | 2-3 | 2 |
| Fast Acid Red A . . . | S | 2 | 3-4 | 4 | 3 | 3-2 | 3-2 | 2-1 | 2-1 | 1-2 | 1-2 | 3 | 3-4 | 3 | 3 | 2 |
| Sulpho Rosazaine B extra . | S | 1 | 1-2 | 4 | 1-2 | 3 | 3 | 1-2 | 2-1 | 1 | 2 | 4 | 3-4 | 3-4 | 3-4 | 2 |
| Sulpho Rosazaine G extra . | S | 1 | 1-2 | 4-3 | 1-2 | 3 | 3 | 1-2 | 2 | 1 | 2 | 4 | 3 | 3-4 | 3-4 | 2 |
| Fast Acid Violet RGE . . | S | 2 | 3-4 | 4 | 3 | 2-3 | 2 | 2 | 1 | 1-2 | 1-2 | 3 | 3-2 | 3 | 2 | 2-3 |
| Fast Acid Violet BE . . | S | 2 | 3-4 | 4 | 3 | 2-3 | 2-3 | 1 | 1 | 1-2 | 1-2 | 3 | 4 | 3 | 3 | 3-4 |
| Rosazaine O | E | 1 | 4 | 5 | 3 | 3-4 | 1-2 | 2 | 2 | 1 | 2 | 4 | 3-4 | 2 | 4 | 3 |
| Acid Magenta G | S | 2-3 | 1 | 1-2 | 1 | 4-5 | 3 | 3 | 2 | 3 | 1 | 3 | 5 | 5 | 2 | 5 |
| Acid Magenta O | S | 2-3 | 1 | 2 | 1 | 4-5 | 3 | 3 | 2 | 3 | 1 | 3 | 5 | 5 | 2 | 5 |
| Acid Magenta B | S | 2-3 | 1 | 1-2 | 1 | 4-5 | 3 | 3 | 2 | 3 | 1 | 3 | 5 | 5 | 2 | 5 |
| Acid Violet 4RS | S | 2-3 | 1 | 1-2 | 1 | 4-5 | 3 | 3 | 2 | 3 | 1 | 3 | 5 | 5 | 2 | 5 |
| Acid Violet 2RA | S | 2-3 | 1 | 2-3 | 2 | 4 | 3-2 | 2 | 2 | 3 | 1 | 3 | 4-5 | 4-5 | 2 | 4 |
| Acid Maroon O | S | 3 | 1 | 2 | 1-2 | 4 | 4 | 4 | 3-2 | 3 | 1 | 3 | 5 | 5 | 2 | 5 |

| Acid Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Water | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|------------------------------------|------------------|---|------------|------|--------------|-----|---------------------|-----|-------------------|-----|--------------------------|-----|-------------|-----|---------------------|-----|-------------------|-----|---------------------|-----|----------------------|----------|---------------------|----------|--------------------|------------|
| | S | E | Cotton | Silk | 4-5 | 5-4 | 2 | 1-2 | 2 | 1-2 | 1 | 2 | 3 | 4 | 3 | 3-4 | 3 | 3-4 | 3 | 3-4 | Change | Bleeding | Change | Bleeding | Soda | Quick lime |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Victoria Blue B | 2-3 | E | 4 | 5 | 4-5 | 5-4 | 2 | 1-2 | 2 | 1-2 | 1 | 3-2 | 4 | 3 | 4 | 2 | 3-2 | 3-4 | 3-4 | 3-2 | 2-3 | 3-2 | 2-3 | 3-2 | 4 | 3-4 |
| Acid Violet 6BN | 3 | S | 2 | 4 | 1-2 | 4-3 | 2 | 1-2 | 2 | 1-2 | 2 | 2 | 3 | 3-4 | 3-4 | 3 | 3-2 | 3 | 3-4 | 3-2 | 2-3 | 3-2 | 2-3 | 3 | 3 | 3-2 |
| Acid Violet 5BF | 3 | S | 4-3 | 4 | 3-4 | 4 | 1-2 | 1 | 4 | 1-2 | 1 | 2 | 3 | 3 | 2-3 | 3-2 | 3 | 3 | 3-2 | 2-3 | 2-3 | 2-3 | 2-3 | 3-2 | 3-2 | 2-3 |
| Acid Violet N | 1-2 | S | 4-3 | 4 | 4 | 4 | 2-1 | 1 | 4 | 2-1 | 1 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 3-2 | 3-2 | 2-3 |
| Neutral Blue R | 3 | S | 3 | 4 | 3 | 4-3 | 2 | 1-2 | 3 | 4-3 | 1 | 1-2 | 3 | 3 | 3 | 3-4 | 3 | 3 | 3-4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Neutral Blue 3R | 3 | S | 3-4 | 4 | 3 | 4 | 1-2 | 1-2 | 4 | 4 | 1-2 | 1 | 1-2 | 3 | 3-2 | 3 | 3 | 3 | 3-2 | 3-2 | 3-2 | 3-2 | 3-2 | 3-2 | 3-2 | 2-3 |
| Neutral Violet O | 2-3 | S | 4 | 4 | 4 | 4 | 1-2 | 1 | 4 | 4 | 1-2 | 3-2 | 4-3 | 3 | 2-3 | 3-4 | 2-3 | 3 | 3-4 | 2-3 | 2-3 | 2-3 | 3 | 2-3 | 2-3 | 2-3 |
| Pure Blue O | 4-5 | S | 3-4 | 4 | 3 | 3 | 3-4 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 4-5 | 5 | 2 | 3 | 4-5 | 5 | 4-5 | 4-5 | 2 | 5 | 5 | 5 |
| Opal Blue super. soluble | 4 | S | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 4-5 | 4-5 | 2 | 3 | 4-5 | 4-5 | 4 | 4 | 2 | 5-4 | 5-4 | 5-4 |
| Navy Blue V | 4 | S | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 4-5 | 4-5 | 2 | 3 | 4-5 | 4-5 | 4 | 4 | 2 | 5-4 | 5-4 | 5-4 |
| Bleu de Lyon O | 4 | S | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 4-5 | 4-5 | 2 | 3 | 4-5 | 4-5 | 4 | 4 | 2 | 5-4 | 5-4 | 5-4 |
| Opal Blue blue shade | 4 | S | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 4-5 | 4-5 | 2 | 3 | 4-5 | 4-5 | 4 | 4 | 2 | 5-4 | 5-4 | 5-4 |
| Soluble Blue SV | 4 | S | 4 | 4 | 4-5 | 3-4 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 4-5 | 4-5 | 2 | 3 | 4-5 | 4-5 | 4 | 4 | 2 | 5-4 | 5-4 | 5-4 |
| Soluble Blue R | 4 | S | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 4-5 | 4-5 | 2 | 3 | 4-5 | 4-5 | 4 | 4 | 2 | 5-4 | 5-4 | 5-4 |

| Alkaline Blue Dyestuffs | Method of Dyeing | | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|----------------------------|------------------|------|------------|-----------------|----------|---------------------|-------------------|-----------------------------|-------------|------------------------|--------|---------------------|--------|-------------------------|------|------------------------|-----|-----------------------|--|
| | Cotton | Silk | | Change | Bleeding | | | | | Fastness to Water | Change | Bleeding | Change | Bleeding | Soda | Quick lime | | | |
| | | | | | | | | | | | | | | | | | | | |
| Methyl Alkali Blue MLB . | Alk | | 1 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2-3 | 3 | 4 | 2 | 4 | 4 | 2 | 4-5 | 4-5 | |
| Alkaline Blue 6B | Alk | | 1 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2-3 | 3 | 4 | 2 | 4 | 4 | 2 | 4 | 4 | |
| Alkaline Blue 4B | Alk | | 1 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2-3 | 3 | 4 | 2 | 4 | 4 | 2 | 4 | 4 | |
| Alkaline Blue 2B | Alk | | 1 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2-3 | 3 | 4 | 2 | 4 | 4 | 2 | 4 | 4 | |
| Alkaline Blue R | Alk | | 1 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2-3 | 3 | 4 | 2 | 4 | 4 | 2 | 4-5 | 4-5 | |
| Alkaline Blue RR | Alk | | 1 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2 | 3 | 4 | 2 | 4 | 4 | 2 | 4-5 | 4-5 | |
| Alkaline Violet O | Alk | | 2 | 4 | 3 | 3 | 3-2 | 1 | 2-3 | 2 | 3 | 4 | 2 | 4 | 4 | 2 | 5-4 | 4-5 | |

| Acid Dyestuffs | Method of Dyeing | Equalising | Affinity for | Fastness to Rubbing | | | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Soda | Quick Lime |
|--------------------------------|------------------|------------|-----------------|---------------------|------|-----|-------------------|--------------------------|-------------|---------------------|----------|-------------------|---------------------|-----|----------------------|----------|---------------------|----------|------------------|------------|
| | | | | Cotton | Silk | | | | | Change | Bleeding | | | | Change | Bleeding | Change | Bleeding | | |
| Patent Blue L | S | 1 | 1-2 | 4 | 2 | 2 | 3 | 1-2 | 2 | 1 | 2 | 4 | 3 | 3 | 3 | 3-4 | 3 | 3-4 | 2 | 2 |
| Patent Blue V | S | 1 | 1-2 | 4 | 2 | 2 | 3 | 1-2 | 2 | 1 | 2 | 4 | 3 | 3 | 3 | 3-4 | 3 | 3-4 | 2 | 2 |
| Patent Blue J3 | S | 1-2 | 2-3 | 4 | 2 | 2 | 3-4 | 1-2 | 2 | 1-2 | 2 | 4 | 3 | 3 | 3 | 3-4 | 3 | 3-4 | 2 | 2 |
| Patent Pure Blue O | S | 1 | 1-2 | 4 | 2 | 2 | 3 | 1-2 | 2 | 1 | 2 | 4 | 3-4 | 3 | 3 | 3-4 | 3 | 3-4 | 2-1 | 2 |
| Cyanine B | S | 1 | 1 | 3 | 2-1 | 3 | 3 | 1-2 | 2 | 1 | 2 | 4 | 3 | 3-4 | 3 | 3 | 3 | 3 | 2-1 | 2 |
| Alizarine Direct Blue E3B | S | 1-2 | 1 | 3 | 2-1 | 2 | 2 | 2-1 | 2 | 1-2 | 1-2 | 3-4 | 3-4 | 3 | 3 | 3 | 3 | 3 | 2 | 2-3 |
| Alizarine Direct Blue EB . | S | 2 | 2 | 3 | 2-1 | 1-2 | 2 | 2 | 2 | 2 | 1 | 3 | 3-4 | 3 | 4 | 2-3 | 3 | 3 | 2 | 3 |
| Alizarine Direct Blue ER extra | S | 2-1 | 1-2 | 3-4 | 2-1 | 2 | 2 | 2-1 | 2-1 | 1-2 | 1-2 | 3-4 | 3-4 | 3 | 4 | 3 | 3 | 3 | 2 | 3 |
| Alizarine Direct Violet R . | S | 3 | 1 | 4-3 | 1-2 | 2-1 | 2-1 | 2-1 | 2 | 1-2 | 1-2 | 3 | 3-4 | 3 | 4 | 2-3 | 3 | 2-3 | 3 | 3 |
| Patent Blue A | S | 2-3 | 3 | 4 | 3 | 3 | 3 | 1-2 | 1-2 | 1 | 1-2 | 3 | 3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2 | 2-1 |
| Indigo Substitute WE . . . | S | 2-3 | 3 | 4 | 3-4 | 3-4 | 3-4 | 2 | 2-1 | 2 | 3 | 3-4 | 3-4 | 2-3 | 3 | 3 | 3-2 | 2-3 | 2 | 2-3 |
| Indigo Substitute BS extra . | S | 2 | 2 | 4 | 2-3 | 3-4 | 2 | 2 | 2 | 1-2 | 2 | 4 | 3-4 | 3-4 | 3-4 | 3 | 3-4 | 3 | 2-3 | 3-2 |
| Indigo Substitute V extra . | S | 1-2 | 2-1 | 4 | 2-3 | 3-4 | 1-2 | 2 | 2 | 2 | 2 | 4 | 3 | 3 | 3 | 3-4 | 3 | 3-4 | 2-3 | 3 |

| Dyestuffs | Method of Dyeing | | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | Fastness to Alkali |
|------------------------------|------------------|-----|------------|--------------|------|---------------------|-------------------|--------------------------|-------------|---------------------|----------|-------------------|---------------------|----------|----------------------|----------|---------------------|--------------------|
| | S | S | | Cotton | Silk | | | | | Change | Bleeding | | Change | Bleeding | Change | Bleeding | | |
| | | | | | | | | | | | | | | | | | | |
| Patent Blue B | 1-2 | 2-3 | 4 | 3-2 | 3-4 | 2-1 | 2 | 2 | 1-2 | 2 | 4 | 3-4 | 3 | 3-4 | 3 | 3-4 | 2-3 | 2-3 |
| Patent Blue Y | 1-2 | 2 | 4 | 2 | 3-4 | 2 | 2 | 2 | 1-2 | 2 | 4 | 3-4 | 3 | 4 | 3 | 3-4 | 3-2 | 2 |
| Patent Blue RBN | 1-2 | 2-1 | 4 | 2 | 4-3 | 2 | 2 | 2 | 2-1 | 2 | 4 | 3 | 3 | 4 | 3 | 3-4 | 3 | 2-3 |
| Acid Green GI | 3 | 2 | 3 | 1-2 | 4-5 | 4 | 2 | 2 | 3-4 | 2 | 4 | 4 | 4 | 3 | 4 | 3 | 4-5 | 4-5 |
| Acid Green conc. | 3 | 1 | 3 | 1-2 | 4 | 4 | 1-2 | 3-4 | 2 | 3-2 | 4 | 4-5 | 2 | 4 | 2 | 2 | 5 | 5 |
| Naphtalene Green V | 1-2 | 1-2 | 3-4 | 2 | 3-4 | 1-2 | 1-2 | 2-3 | 2 | 3-4 | 3 | 3-2 | 3-2 | 3-2 | 3 | 3 | 3 | 3 |
| Fast Acid Green BB extra | 1-2 | 1-2 | 4-3 | 2 | 3 | 1-2 | 2-1 | 2 | 2 | 4-3 | 3 | 3 | 3 | 3 | 3 | 3-4 | 2-3 | 2-3 |
| Patent Green O | 2-3 | 2 | 4-3 | 1-2 | 3-4 | 3 | 1-2 | 3-2 | 2 | 4 | 4-3 | 4-3 | 3 | 4 | 3-4 | 3-4 | 3-4 | 3-4 |
| Patent Green V | 2 | 2 | 4-3 | 2 | 3-4 | 3-2 | 1-2 | 2-3 | 2 | 4 | 3-4 | 3-4 | 3 | 3-4 | 3 | 3 | 3 | 2-3 |
| Patent Green VS | 1-2 | 2 | 4-3 | 2 | 3 | 2 | 1-2 | 2-1 | 2 | 4 | 3-4 | 3 | 3 | 3 | 3 | 3-4 | 1-2 | 2 |

| Resorcine Dyestuffs | Method of Dyeing | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali |
|--------------------------------|------------------|------------|--------------|------|---------------------|-------------------|--------------------------|-------------|---------------------|----------|-------------------|---------------------|----------------------|----------|---------------------|----------|--------------------|
| | | | Cotton | Silk | | | | | Change | Bleeding | | | Change | Bleeding | Change | Bleeding | |
| Eosine 3G | E | 4 | 2 | 4-3 | 2 | 5 | 2 | 4 | 2 | 1 | 3-4 | 3-4 | 3 | 3 | 2-3 | 3 | 2 |
| Eosine extra AG | E | 4 | 1-2 | 4-3 | 2 | 5 | 1-2 | 3 | 1 | 1 | 3 | 3-4 | 2-3 | 3 | 2-3 | 3 | 1-2 |
| Eosine extra soluble | E | 4 | 1 | 4 | 2 | 5 | 1-2 | 2 | 2 | 1 | 3 | 3-4 | 2-3 | 3 | 2-3 | 3 | 1-2 |
| Erythrosine extra | E | 4-5 | 1 | 4 | 2 | 5 | 2-3 | 4 | 2-3 | 1 | 3 | 3 | 2-3 | 3 | 2-3 | 2-3 | 1 |
| Phloxine O | E | 5-4 | 1 | 4 | 2 | 5 | 3 | 4 | 2-3 | 1 | 3 | 3 | 2-3 | 3 | 2-3 | 2-3 | 1 |
| Phloxine B | E | 5-4 | 1 | 4 | 2 | 5 | 3 | 4-3 | 2-3 | 1 | 3 | 3 | 2-3 | 3 | 2-3 | 2-3 | 1-2 |
| Rose Bengale B | E | 5 | 1 | 4 | 2 | 5 | 3 | 4-3 | 2-3 | 1 | 3-2 | 3 | 2 | 2-3 | 2-3 | 2 | 1-2 |

| Basic Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | | |
|-----------------------------|------------------|------|------------|------|--------------|------|---------------------|------|-------------------|------|--------------------------|------|-------------|------|---------------------|------|---------------------|------|----------------------|------|---------------------|------|--------------------|------|-----|
| | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | Cotton | Silk | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| Methylene Yellow H . . . | N | 1 | 4 | 5 | 3 | 5 | 5 | 5 | 4-5 | 1 | 4 | 5 | 5 | 5 | 3 | 5 | 3 | 4 | 4 | 5 | 3 | 4 | 4 | 5 | 4-5 |
| Auramine conc. | N | 1 | 4 | 5 | 3 | 5-4 | 5 | 4 | 4 | 1 | 4 | 5 | 4 | 3 | 5 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 |
| Flavophosphine GG conc. new | N | 2 | 4 | 5 | 4 | 5 | 2 | 2 | 2 | 2 | 3 | 5 | 4-5 | 2-3 | 5 | 3 | 4 | 5 | 4 | 2-3 | 5 | 3 | 4 | 2-3 | |
| Flavophosphine R conc. new | N | 2 | 4 | 5 | 4 | 5 | 2 | 2 | 2 | 2 | 3 | 5 | 4-5 | 2 | 5 | 3 | 4 | 5 | 4 | 2 | 5 | 3 | 4 | 2-3 | |
| Chrysoidine A crystals . . | N | 2 | 4 | 5 | 5 | 4-5 | 3-4 | 3 | 3 | 3 | 3 | 5 | 4 | 2-3 | 5 | 3 | 4 | 5 | 4 | 2-3 | 5 | 3 | 4 | 2-3 | |
| Phosphine extra | N | 2 | 4 | 5 | 5 | 5 | 3 | 2 | 2 | 2 | 4 | 5 | 4 | 4 | 5 | 4-3 | 4 | 5 | 4 | 4-3 | 4 | 4 | 4 | 4 | |
| Vesuvine O | N | 1 | 4 | 5 | 5 | 5 | 3 | 2-3 | 2 | 2 | 3 | 5 | 4 | 4 | 4 | 3-4 | 4 | 4 | 4 | 3-4 | 4 | 3 | 3 | 3 | |
| Rosazine G extra | N | 1 | 4 | 5 | 3 | 3-4 | 1-2 | 2 | 2 | 1 | 2 | 4 | 3-4 | 2 | 4 | 2 | 4 | 4 | 2 | 3 | 2 | 3 | 1-2 | 1-2 | |
| Rosazine B | N | 1 | 4 | 5 | 3 | 3-4 | 1-2 | 2 | 2 | 1 | 2 | 4 | 3-4 | 2 | 4 | 2 | 4 | 4 | 2 | 3 | 2 | 3 | 1-2 | 2 | |
| Safranine O | N | 2 | 4 | 5 | 4 | 5 | 2 | 3 | 2 | 2 | 4 | 5 | 4-5 | 2 | 5 | 2 | 5 | 4 | 2 | 4 | 2 | 4 | 1-2 | 1-2 | |
| New Magenta O | N | 1 | 4 | 5 | 4 | 4-5 | 1-2 | 3 | 2 | 2 | 5 | 5 | 4 | 3 | 5 | 3 | 5 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | |

| Basic Dyestuffs | Method of Dyeing | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Soda |
|------------------------------|------------------|------------|--------------|------|---------------------|-------------------|--------------------------|-------------|---------------------|----------|-------------------|---------------------|----------|----------------------|----------|---------------------|----------|------------------|
| | | | Cotton | Silk | | | | | Change | Bleeding | | Change | Bleeding | Change | Bleeding | Change | Bleeding | |
| Methyl Violet 5R super. | N | 1 | 4 | 5 | 4 | 4-5 | 1-2 | 3 | 2 | 5 | 5 | 4-3 | 3 | 3 | 5 | 3 | 4 | 3 |
| Methyl Violet 3R super. | N | 1 | 4 | 5 | 4 | 4-5 | 1-2 | 2-3 | 2 | 5 | 5 | 4-3 | 3 | 3 | 5 | 3 | 4 | 2-3 |
| Methylene Heliotrope O | N | 2 | 4 | 5 | 4 | 5 | 1-2 | 2 | 1 | 4 | 5 | 4 | 2 | 4 | 2 | 3-4 | 1-2 | 1-2 |
| Methyl Violet BB | E | 1 | 4 | 5 | 4 | 4-5 | 2 | 1-2 | 2 | 5 | 5 | 3 | 3 | 5 | 2-3 | 4 | 2-3 | 2 |
| Methyl Violet 6B super. | E | 1 | 4 | 5 | 4 | 4-5 | 1-2 | 1-2 | 2 | 5 | 5 | 3 | 3 | 5 | 2-3 | 4 | 2-3 | 2 |
| Violet crystals O | E | 1 | 4 | 5 | 4 | 4-5 | 1-2 | 1-2 | 2 | 5 | 5 | 3-4 | 3 | 5 | 2-3 | 4 | 2-3 | 2 |
| Victoria Blue 4R | N | 2 | 4 | 5 | 4 | 5 | 2-3 | 1-2 | 1-2 | 4 | 4 | 3-4 | 3 | 4 | 2-3 | 3 | 4 | 3-4 |
| Victoria Blue B | N | 2 | 4 | 5 | 4 | 5 | 2 | 1-2 | 1-2 | 4 | 4 | 3-4 | 4 | 4 | 3 | 3 | 4 | 4 |
| Malachite Green cryst. extra | Sb | 2 | 4 | 5 | 4 | 3 | 1 | 1-2 | 2-3 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 5 | 4-5 |
| Brilliant Green cryst extra | Sb | 2 | 4 | 5 | 4 | 3 | 1 | 1-2 | 2-3 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 5 | 4-5 |

| Developing Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | Fastness to Rubbing | | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali |
|-----------------------------|------------------|------|------------|----------|-----------------|---------------------|--------|-------------------|-----------------------------|-------------|---------------------|--------|-------------------|-----|----------------------|-----|---------------------|-----|--------------------------|
| | Cotton | Silk | Change | Bleeding | | Fastness to Washing | Change | | | | Bleeding | Change | Bleeding | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Alizarine Yellow 5G. . . | Cr | 2-1 | 3-4 | 3 | 2 | 2 | 2-1 | 1 | 3 | 2-3 | 1 | 2 | 1-2 | 2-1 | 2 | 1 | 2 | 2 | 1-2 |
| Mordant Yellow O . . . | Cr | 2-3 | 1 | 1 | 2 | 2 | 2-1 | 1 | 3 | 2-3 | 1 | 2-1 | 2-1 | 1-2 | 2-1 | 1 | 2-1 | 2 | 1-2 |
| Alizarine Yellow GGW powder | Cr | 1-2 | 2-3 | 2-3 | 2 | 2 | 2-1 | 1 | 2-3 | 2-3 | 1 | 2 | 1-2 | 1-2 | 2 | 1 | 2 | 2 | 1-2 |
| Acid Alizarine Yellow RC . | Cr | 4-5 | 3-4 | 3-2 | 3 | 2 | 2 | 1 | 3 | 2-3 | 1 | 1 | 1 | 1 | 1-2 | 1-2 | 1 | 2 | 1-2 |
| Alizarine Yellow RW powder | Cr | 2-1 | 3-4 | 3 | 2 | 2 | 2 | 2-1 | 3-4 | 3 | 2 | 2-3 | 2-3 | 1-2 | 3-2 | 1-2 | 2-3 | 2 | 1-2 |
| Dianil Fast Red PH. . | Cr | 5 | 4-5 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Alizarine Red IWS . . . | Cr | 1-2 | 1 | 1-2 | 2 | 1 | 2 | 2 | 3 | 3 | 1 | 1-2 | 1-2 | 2 | 1-2 | 2 | 1-2 | 2 | 2 |
| Acid Alizarine Red G . . | Cr | 2-3 | 1-2 | 2-3 | 1-2 | 1 | 1 | 1 | 2-3 | 1 | 1 | 2 | 3-2 | 1-2 | 2 | 1-2 | 2-1 | 1-2 | 2-3 |
| Acid Alizarine Red B . . | Cr | 2-3 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 2-3 | 1-2 | 2 | 1-2 | 2-1 | 2 | 2-1 |
| Acid Alizarine Grenade R. | Cr | 1-2 | 1-2 | 2-3 | 1-2 | 1 | 2 | 1 | 1-2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1-2 |
| Acid Alizarine Brown R . | Cr | 2 | 4 | 3 | 3-4 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1-2 | 2-1 | 1-2 | 1 | 1-2 | 1-2 | 2 |
| Acid Alizarine Brown B . | Cr | 2 | 4 | 3 | 4 | 1-2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Acid Alizarine Brown BB . | Cr | 2-3 | 4 | 3 | 3-4 | 1-2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Acid Alizarine Brown T . | Cr | 2-3 | 4 | 3 | 3-4 | 1-2 | 1-2 | 1-2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Acid Alizarine Brown RR. | Cr | 2 | 3 | 3 | 2-3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1-2 | 1-2 | 2 | 1 | 1-2 | 1 | 1-2 |

| Developing Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|-----------------------------------|------------------|------|------------|-----|-----------------|-----|---------------------|-----|-------------------|-----|-----------------------------|-----|-------------|-----|---------------------------|----------|---------------------|-----|----------------------------|----------|---------------------------|-----|--------------------------|-----|
| | Cotton | Silk | Cr | K | Cr | K | Cr | K | Cr | K | Cr | K | Cr | K | Change | Bleeding | Cr | K | Change | Bleeding | Cr | K | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Chromogene I | 1 | 1-2 | 2 | 2 | 1-2 | 2 | 2 | 2-3 | 1 | 2-1 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2-3 |
| Chrome Brown RO | 4 | 2-3 | 3 | 3 | 2-3 | 3 | 2-3 | 3 | 2-3 | 3 | 1-2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2-3 | 1-2 | 2 | 2 | 2 | 2 |
| Copper Red N | 3 | 3-4 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 5 | 1-2 | 3-4 | 3-4 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 4 | 2 | 4 | |
| Copper Blue B extra | 5 | 2 | 2 | 2 | 2-3 | 3 | 2-3 | 3 | 2-3 | 2 | 1-2 | 3-2 | 3 | 2 | 3-2 | 3 | 2 | 3-2 | 2-1 | 2-3 | 1-2 | 2-3 | 1-2 | 2-3 |
| Copper Blue B | 3-4 | 1-2 | 2 | 2 | 1-2 | 2 | 2 | 2 | 2-3 | 3 | 1-2 | 3 | 3-4 | 4 | 3-4 | 3 | 3-4 | 3 | 3-4 | 2 | 3 | 2 | 3 | |
| Copper Black SB | 4 | 1-2 | 2 | 2 | 1-2 | 2 | 2 | 2 | 2 | 3-2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| Copper Black S | 4 | 1-2 | 2-1 | 1-2 | 2 | 2 | 2-1 | 2 | 2 | 3-2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| Chromotrope Blue WG | 3-4 | 2-3 | 2-3 | 2-1 | 2-1 | 2-1 | 2-1 | 2-1 | 1-2 | 1 | 1 | 2-3 | 2-3 | 2-1 | 2-3 | 1 | 2-3 | 2-3 | 2-1 | 2-3 | 1-2 | 2-1 | 1-2 | 2 |
| Chromotrope Blue WB | 3-4 | 2-3 | 2-3 | 2-1 | 2-1 | 2-1 | 2-1 | 2-1 | 1-2 | 1 | 1 | 2-3 | 2-3 | 2-1 | 2 | 2 | 2-3 | 2-3 | 2-1 | 2 | 1-2 | 2-1 | 1-2 | 2 |
| Chromotrope Blue A | 3-4 | 2 | 2-3 | 1-2 | 1-2 | 2 | 1-2 | 2 | 1-2 | 1 | 1 | 3 | 2-3 | 2-3 | 3-2 | 2 | 2-3 | 2-3 | 3-2 | 2 | 2-3 | 2 | 2 | 2 |
| Chromotrope F4B | 3-4 | 1 | 2 | 1-2 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 | 1 | 1 | 1-2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 2 | 2-1 | 2-1 | 2 | 2 | 2 |
| Chromotrope DW | 3-4 | 1 | 1 | 1-2 | 2 | 1-2 | 2 | 1-2 | 1-2 | 1 | 1 | 1 | 2-1 | 1 | 1 | 1 | 1 | 2-1 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 2-1 |
| Chromotrope FB | 3-4 | 1-2 | 1 | 1-2 | 2-1 | 2 | 1-2 | 2 | 1-2 | 1 | 1 | 2-1 | 2 | 2 | 2 | 2 | 2 | 2 | 2-3 | 2 | 2 | 2 | 2-1 | 2 |
| Acid Alizarine Violet N | 3 | 1-2 | 2 | 1-2 | 1-2 | 2 | 1-2 | 2 | 1-2 | 1-2 | 1 | 2-1 | 2-3 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 |

| Developing Dyestuffs | Method of Dyeing | | Equalising | Affinity for | | Fastness to Rubbing | | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Change | Bleeding | Fastness to Scouring | | Change | Fastness to Milling | Fastness to Alkali | Quick time |
|-------------------------------|------------------|------|------------|--------------|----------|---------------------|----------|-------------------|--------------------------|-------------|---------------------|-----|-------------------|---------------------|-----|--------|----------|----------------------|-----|--------|---------------------|--------------------|------------|
| | Cotton | Silk | | Change | Bleeding | Change | Bleeding | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Acid Alizarine Blue GR | Fl | 4 | 3-4 | 3-4 | 2-3 | 2 | 2 | 3 | 2-1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 3 | 1 | 4 | 4 | 3-4 | 3-4 | 1 | 1-2 | |
| Acid Alizarine Blue BB | Fl | 2-3 | 2 | 2 | 1-2 | 2 | 2 | 3-2 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 3 | 1 | 4 | 4 | 3-4 | 3-4 | 1 | 1-2 | |
| Acid Alizarine Dark Blue SN | Fl | 3-2 | 3-4 | 3-4 | 2 | 2 | 2 | 3-2 | 1-2 | 1-2 | 2 | 1-2 | 1 | 1-2 | 3 | 1 | 3-4 | 3-4 | 3-4 | 3-4 | 1 | 1-2 | |
| Fast Mordant Blue B | Cr | 3 | 2 | 2-1 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | |
| Fast Mordant Blue R | Cr | 2-3 | 2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-1 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | |
| Fast Mordant Blue EG | Cr | 3-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 | 1 | 1-1 | 1-2 | 1 | 1-2 | 1-2 | 2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | |
| Alizarine Blue Black B | Cr | 3 | 3 | 2-3 | 2-3 | 1-2 | 1-2 | 2-1 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | |
| Acid Alizarine Blue Black 3BN | Cr | 3-4 | 3-4 | 3 | 2 | 2-1 | 2-1 | 1-2 | 1-2 | 1-2 | 1 | 1 | 2-1 | 2 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | |
| Acid Alizarine Blue Black A | Cr | 3-4 | 1-2 | 3 | 1-2 | 2-1 | 2-1 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 1-2 | |
| Acid Alizarine Blue WE | Cr | 4-3 | 4 | 3-4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2-3 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1-2 | |
| Chromotrope 8B | Cr | 4 | 1 | 2 | 1-2 | 3 | 3 | 2-3 | 1-2 | 1-2 | 1 | 1 | 2 | 2 | 2 | 2 | 2-3 | 2-1 | 2-3 | 3-4 | 3 | 1-2 | |
| Ceruleine BWR | Cr | 4 | 4 | 4 | 4 | 4 | 2-3 | 3 | 4 | 4 | 3 | 1 | 2 | 1-2 | 2 | 1-2 | 2 | 1-2 | 2 | 1-2 | 1-2 | 1-2 | |
| Acid Alizarine Green G | Cr | 4 | 1-2 | 2-3 | 2 | 2 | 3 | 3-2 | 2 | 2 | 1 | 1 | 1 | 2 | 3-2 | 1-2 | 2-3 | 1 | 3-2 | 2-3 | 2-3 | 2-3 | |
| Acid Alizarine Grey G | Ci | 4 | 4 | 3-4 | 3 | 3 | 2-3 | 2-1 | 1-2 | 1-2 | 2-1 | 1 | 2 | 2-3 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 | |
| Acid Alizarine Blue Black B | Cr | 4 | 4-3 | 3 | 2 | 2 | 2 | 1-2 | 1-2 | 1-2 | 1 | 1 | 2 | 2-3 | 2-1 | 2-1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 | |
| Acid Alizarine Blue Black 3B | Cr | 4 | 3-4 | 3 | 2 | 2 | 2 | 1-2 | 1-2 | 1-2 | 1 | 1 | 2-1 | 2-3 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 1 | |
| Chromotrope 10B | Cr | 4 | 2 | 2-3 | 2-3 | 2 | 2 | 2 | 1-2 | 1-2 | 1 | 1 | 2 | 2 | 2 | 2-3 | 1-2 | 2-3 | 1-2 | 2-3 | 2 | 2 | |
| Chromotrope S | Ci | 4 | 2 | 3 | 1 | 1 | 1 | 1-2 | 1-2 | 1-2 | 1 | 1 | 2 | 2-1 | 1-2 | 2-3 | 2-1 | 2 | 2-3 | 2-1 | 2 | 2 | |

| Developing (Vigoureux) Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Carbonising | | Change Stoving | | Fastness to Washing | | Change Scouring | | Change Milling | | Fastness to Alkali | |
|--|------------------|--|------------|--|--------------|---|---------------------|-----|-------------------|-----|--------------------------|-----|-------------|-----|----------------|---|---------------------|-----|-----------------|-----|----------------|-----|--------------------|-----|
| | | | | | Cotton | | | | | | | | | | Bleeding | | | | Bleeding | | Bleeding | | Soda | |
| Vigoureux Yellow I . . . | | | | | — | — | 2 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2-3 3-2 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 |
| Vigoureux Red I . . . | | | | | — | — | 1-2 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1-2 | 1 | 1 | 2-1 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 2 |
| Lanoglucine W . . . | | | | | — | — | 2 | 3-2 | 2-3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 1-2 | 1 | 1-2 | 1 | 1-2 | 2-1 | 1 |
| Vigoureux Brown I . . . | | | | | — | — | 3 | 1-2 | 2 | 2-1 | 2-1 | 1-2 | 1-2 | 1-2 | 1 | 1 | 2-3 3 | 2 | 2 | 2-1 | 2 | 2-1 | 1-2 | 1-2 |
| Vigoureux Grey I . . . | | | | | — | — | 3 | 2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 | 2-3 3-2 | 1-2 | 2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 |
| Vigoureux Black I . . . | | | | | — | — | 2 | 1-2 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3-2 2-3 | 1-2 | 2-3 | 1-2 | 1-2 | 1-2 | 1 | 1-2 |
| Vigoureux Black RU . . . | | | | | — | — | 2 | 1-2 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2-3 2-3 | 1-2 | 2-3 | 1-2 | 1-2 | 1-2 | 1 | 1-2 |

Alizarine- and
Mordant-Dyestuffs

| Alizarine- and Mordant-Dyestuffs | Method of Dyeing | Equalising | Affinity for | | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | | Fastness to Washing | | Change Scouring | Change Milling | Bleeding | Fastness to Soda | Quicklime |
|-------------------------------------|------------------|------------|--------------|------|---------------------|-------------------|--------------------------|-------------|---------------------|----------|-------------------|-----------------|---------------------|----------|-----------------|----------------|----------|------------------|-----------|
| | | | Cotton | Silk | | | | | Change | Bleeding | Fastness to Water | Change Scouring | Change Milling | Bleeding | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Alizarine Yellow paste . . | CrV | — | 3 | 3 | 2-3 | 1 | 1 | 3 | 3-4 | 1 | 1 | 1 | 1 | 1 | 2 | 1-2 | 1 | 2 | 2 |
| Alizarine Yellow 5G . . . | CrV | — | 2 | 2 | 2 | 2-1 | 1 | 2 | 2-3 | 1 | 3-2 | 2-1 | 1-2 | 2-3 | 1-2 | 1 | 2-3 | 1-2 | 1-2 |
| Alizarine Yellow GGW powder | CrV | — | 2 | 2-3 | 2 | 2-1 | 1 | 2 | 2-3 | 1 | 2-3 | 1-2 | 1-2 | 2-3 | 1-2 | 1 | 2-3 | 1-2 | 1-2 |
| Mordant Yellow O . . . | CrV | — | 1 | 2-1 | 2 | 2 | 2 | 2-3 | 2-3 | 1 | 2-1 | 2 | 1-2 | 2 | 1-2 | 1 | 2 | 1-2 | 1-2 |
| Acid Alizarine Yellow RC . | CrV | — | 4 | 3 | 3-4 | 2-1 | 1 | 2-3 | 2-3 | 1 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 | 1-2 | 1-2 |
| Alizarine Orange N paste . | AlV | — | 4 | 3-4 | 4 | 1 | 2 | 3 | 2-3 | 1-2 | 2 | 1-2 | 2-3 | 2-3 | 2 | 2 | 2 | 3 | 3 |
| Alizarine Orange N paste . | CrV | — | 4 | 3 | 3 | 1 | 1 | 2-3 | 1-2 | 1 | 2 | 1-2 | 1-2 | 2-1 | 1 | 1-2 | 1 | 2-1 | 2-1 |
| Alizarine Yellow RW . . | CrV | — | 2-3 | 3 | 2-3 | 2-1 | 1 | 3 | 3 | 2 | 3 | 2 | 2-1 | 2-3 | 1-2 | 2-3 | 2-1 | 1 | 1 |
| Alizarine Red 1WS powder | AlV | — | 4 | 3 | 3 | 1 | 1 | 3 | 2-3 | 1-2 | 2 | 2-3 | 1-2 | 2 | 2 | 2 | 1-2 | 2-1 | 2-3 |
| Alizarine Red 1WS powder | CrV | — | 2 | 2 | 2-3 | 1 | 1-2 | 3 | 2-3 | 3-1 | 2 | 2 | 1-2 | 2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 |
| Alizarine Red PS powder . | AlV | — | 2-3 | 2-3 | 3 | 1 | 1-2 | 3 | 2-3 | 1-2 | 2-1 | 2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 3 |
| Alizarine Red PS powder . | CrV | — | 2 | 2 | 2-3 | 1 | 1-2 | 3 | 2-3 | 1-2 | 2 | 1-2 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 |
| Alizarine Red 1W paste . | AlV | — | 4 | 3 | 3-4 | 1 | 1-2 | 3 | 2-3 | 2 | 2-3 | 1-2 | 2-3 | 2-3 | 2 | 2 | 2 | 2-3 | 3 |
| Alizarine Red 1W paste . | CrV | — | 4 | 3 | 2-3 | 1 | 1 | 3-4 | 3 | 2 | 2 | 1-2 | 2 | 2-1 | 2 | 2 | 2 | 2 | 2-3 |
| Alizarine Red 1W paste . | CrV | — | 4 | 3 | 2-3 | 1 | 1 | 3-4 | 3 | 2 | 2 | 1-2 | 2 | 2-1 | 2 | 2 | 2 | 2 | 2-3 |

| Alizarine- and Mordant-Dyestuffs | Equalising | | Affinity for | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Washing | Fastness to Scouring | | Fastness to Milling | | Fastness to Soda | Quicklime |
|-------------------------------------|------------|------|-----------------|---------------------|-------------------|-----------------------------|-------------|---------------------|----------|---------------------|----------------------|----------|---------------------|----------|---------------------|-----------|
| | Cotton | Silk | | | | | | Change | Bleeding | | Change | Bleeding | Change | Bleeding | | |
| Alizarine Red 2BW paste . | 4 | 3 | 3-4 | 1 | 1-2 | 2-3 | 2-3 | 2 | 2 | 2 | 2-3 | 3 | 2 | 2 | 2-3 | 3 |
| Alizarine Red 2BW paste . | 4 | 3 | 2-3 | 1 | 1 | 3-4 | 3 | 3 | 2 | 2 | 2-3 | 2-3 | 2 | 2-1 | 2 | 2-3 |
| Alizarine Claret R paste . | 4 | 3 | 3 | 1-2 | 2 | 3-4 | 2 | 2 | 2 | 2 | 2 | 2-1 | 2 | 2-1 | 2 | 2 |
| Alizarine Brown paste . . | 4 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-3 | 3 |
| Alizarine Brown N paste . | 4 | 3 | 3 | 3 | 2-3 | 3 | 2 | 1 | 1 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-3 | 3 |
| Alizarine Brown F paste . | 4 | 3 | 3 | 2 | 2-3 | 3 | 2 | 1 | 1 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-3 | 3 |
| Alizarine Brown WR paste | 4 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-3 | 3 |
| Alizarine Blue B paste . . | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue F paste . . | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue A paste . . | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue DNW paste | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue R paste . . | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue Black B . . | 2-3 | 2-3 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 |
| Alizarine Dark Blue S paste | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1-2 | 2 | 1-2 | 2 | 3 |
| Anthrol Blue NR paste . . | 4 | 3 | 3 | 2-1 | 2 | 2-3 | 1 | 1-2 | 1-2 | 2-1 | 2 | 2 | 2-3 | 2 | 2-3 | 3 |

| Alizarine- and Mordant-Dyestuffs | Method of Dyeing | | Equalising | | Affinity for | | Fastness to Rubbing | | Fastness to Light | | Fastness to Dry Steaming | | Fastness to Stoving | | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|-------------------------------------|------------------|------|------------|---|--------------|-----|---------------------|-----|-------------------|---|--------------------------|-----|---------------------|----------|---------------------|-----|----------------------|----------|---------------------|----------|--------------------|------------|
| | Cotton | Silk | — | — | — | — | — | — | — | — | — | — | Change | Bleeding | — | — | Change | Bleeding | Change | Bleeding | Soda | Quick lime |
| | | | | | | | | | | | | | | | | | | | | | | |
| Alizarine Blue SB paste . | 4 | 3 | — | — | 3-2 | 2 | 2 | 3 | 3 | 1 | 1 | 1-2 | 1 | 1 | 1-2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue SRW paste . | 4 | 3 | — | — | 3-2 | 2 | 2 | 3 | 3 | 1 | 1 | 1-2 | 1 | 1 | 1-2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 |
| Alizarine Blue SRX paste . | 4 | 3 | — | — | 3-2 | 2 | 2 | 3 | 3 | 1 | 1 | 1-2 | 1 | 1 | 1-2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 |
| Fast Mordant Blue B . . | 1 | 2 | — | — | 1-2 | 1-2 | 1 | 2-1 | 1-2 | 1 | 2-1 | 3 | 1-2 | 2-1 | 3 | 1-2 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 | 2 |
| Fast Mordant Blue R . . | 1 | 2 | — | — | 1-2 | 1-2 | 1-2 | 2-1 | 1-2 | 1 | 2 | 3 | 1-2 | 2 | 3 | 1-2 | 1-2 | 2-1 | 1-2 | 2-1 | 2-1 | 2-3 |
| Galleine W powder . . . | 4 | 3 | — | — | 2 | 3 | 3 | 3-4 | 3 | 1 | 3-4 | 2-3 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 2 |
| Galleine paste A . . . | 4 | 3 | — | — | 2-3 | 3 | 3 | 3-4 | 3 | 1 | 3-4 | 2-3 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 2 |
| Ceruleine paste A . . . | 4 | 3 | — | — | 3 | 3 | 2 | 2 | 2 | 2 | 1-2 | 1-2 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 | 3 |
| Ceruleine S | 4 | 3 | — | — | 3 | 3 | 2 | 2 | 2 | 2 | 1-2 | 1-2 | 1 | 1 | 1-2 | 1 | 2 | 1 | 2 | 1 | 3 | 3 |
| Ceruleine paste SW . . . | 4 | 3 | — | — | 3 | 2 | 2 | 2 | 2 | 2 | 1-2 | 1-2 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 3 | 3 |
| Ceruleine BWR | 4 | 3 | — | — | 4 | 2-3 | 1 | 2 | 1-2 | 1 | 1-2 | 2 | 1-2 | 2 | 1-2 | 2 | 1 | 2 | 1 | 2 | 1-2 | 2 |
| Alizarine Green S paste . | 4 | 3 | — | — | 3-4 | 3-2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 2-3 | 2 | 1-2 | 2 | 2 | 2 | 2 | 1-2 | 3 | 2-3 |

| Indigo and Vat Colours | Method of Dyeing | Egualising | Affinity for Cotton Silk | Fastness to Rubbing | Fastness to Light | Fastness to Dry Steaming | Carbonising | Fastness to Stoving | | Fastness to Water | Fastness to Washing | | Fastness to Scouring | | Fastness to Milling | | Fastness to Alkali | |
|------------------------------------|------------------|------------|-----------------------------------|---------------------|-------------------|-----------------------------|-------------|------------------------|----------|-------------------|---------------------|---|-------------------------|----------|------------------------|----------|-----------------------|------------|
| | | | | | | | | Change | Bleeding | | | | Change | Bleeding | Change | Bleeding | Soda | Quick lime |
| Indigo MLB/R | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |
| Indigo MLB | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |
| Indigo MLB/RR | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |
| Indigo MLB/2B | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |
| Indigo MLB/4B | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |
| Helindone Red 3B | HK | — | 4 4 | 3-4 | 1 | 2-1 | 2-1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 |
| Helindone Red B | HK | — | 4 4 | 3-4 | 1 | 2-1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 |
| Helindone Fast Scarlet R | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Helindone Orange R | HK | — | 4 4 | 3 | 1 | 2-1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Helindone Brown G | HK | — | 4 4 | 3-4 | 1-2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Helindone Blue 2B | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Helindone Grey 2B | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |
| Helindone Orange D | HK | — | 4 4 | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 |

B. COTTON COLOURS.

Method of Dyeing.

The letters in the first columns refer to the method of dyeing:

| | | | |
|-----|---|-----|--|
| TV | Tannin Mordant. | N | Dyed direct; then diazotised on the fibre and developed with Beta Naphtol. |
| TN | Dyed direct; then after-treated with Tannin-Antimony. | NG | On Beta Naphtol ground. |
| D | Dyed direct | KP | Padded; then dyed with Paranitraniline. |
| DD | Dyed direct and developed by Steaming. | NS | Dyed direct; diazotised on the fibre developed with . . . and finally aftertreated with Solidogen. |
| S | Dyed direct and developed with Solidogen. | Sa | Dyed direct, diazotised on the fibre and developed with Soda. |
| Cr | Dyed direct and developed with Chrome Salts (Oxides). | Az | Dyed direct and developed on the fibre with Azophor Red (or diazotised Paranitraniline). |
| KCr | Dyed direct and developed with Copper Sulphate and Bichrome. | AlV | Dyed on Alumina Mordant. |
| K | Dyed direct and developed with Copper Sulphate. | CrV | Dyed on Chrome Mordant. |
| Cl | Dyed direct and developed with Chloride of Lime. | FeV | Dyed on Iron Mordant. |
| Ph | Dyed direct; then diazotised on the fibre and developed with Phenol. | HK | Dyed in the Hydrosulphite vat. |
| PhD | Dyed direct; then diazotised on the fibre and developed with Metaphenylene Diamine. | | |

Fastness to Rubbing.

The dyed patterns were rubbed vigorously with white cotton.

1. Colour does not rub in deep shades.
2. Colour rubs slightly in deep shades.
3. Colour rubs noticeably in deep shades.
4. Colour rubs noticeably in medium shades.
5. Colour rubs very considerably in medium shades.

Fastness to Ironing.

In order to test the resistance of a colour to hot ironing and pressing, a hot iron was placed upon the pattern and the change of shade registered:

1. Colour withstands hot ironing and pressing without change of shade.
2. Colour changes slightly in ironing, but the original shade returns on cooling.

3. Colour changes considerably in ironing, but the original shade returns on cooling.
4. Colour changes slightly, but permanently, in ironing.
5. Colour changes considerably and permanently in ironing.

Fastness to Light.

1. Colour does not change, or only very slightly, after 1 month's exposure.
2. Colour changes considerably after 1 month's exposure; the change is slightly noticeable after 14 days.
3. Colour changes slightly after 1 week's exposure; the change is very pronounced after a fortnight.
4. Colour changes considerably in a week.
5. Colour changes considerably in a day.

Fastness to Alkali.

The patterns were immersed for 2 minutes in concentrated Ammonia and in Soda solution 10%, and then dried without rinsing.

1. Colour is not changed by either Ammonia or Soda.
2. Colour is slightly changed by Ammonia or Soda.
3. Colour is noticeably changed by Ammonia or Soda.
4. Colour is considerably changed.
5. Colour is destroyed or the shade entirely changed.

Fastness to Muriatic acid.

The patterns were spotted with diluted Muriatic acid (100 parts concentrated acid 35° Tw. per 1000). The effect of this test was registered after 10 minutes.

1. No change.
2. Slight change.
3. Noticeable change.
4. Great change.
5. Colour is destroyed or the shade entirely changed.

Fastness to Acetic acid.

The patterns were spotted with Acetic acid 12° Tw. and the change registered after 10 minutes.

1. No change.
2. Slight change.
3. Noticeable change.
4. Considerable change.
5. Entire change.

Fastness to Chlorine.

The patterns were treated with Chloride of Lime solutions of 1½° Tw. and of ⅓° Tw. for 1 hour cold.

1. Colour withstands strong Chloride of Lime solution.
2. Colour withstands Chloride of Lime of $\frac{1}{8}^{\circ}$ Tw. but is slightly changed of Chloride of Lime of $1\frac{1}{2}^{\circ}$ Tw.
3. Colour is slightly changed by Chloride of Lime solution $\frac{1}{8}^{\circ}$ Tw. and considerably changed by Chloride of Lime of $1\frac{1}{2}^{\circ}$ Tw.
4. Colour is considerably changed by Chloride of Lime of $\frac{1}{8}^{\circ}$ Tw. and entirely destroyed by Chloride of Lime of $1\frac{1}{2}^{\circ}$ Tw.
5. Colour is entirely destroyed by Chloride of Lime of $\frac{1}{8}^{\circ}$ Tw.

Fastness to Water.

The patterns were plaited with white wool and cotton yarn and boiled for $\frac{1}{2}$ an hour in calcareous well water; another plait was then immersed for 12 hours in distilled water (poured on hot, and allowed to cool gradually).

1. Colour does not bleed in either case.
2. Colour bleeds slightly in boiling, but stands the immersion.
3. Colour bleeds slightly when immersed, but considerably when heated.
4. Colour bleeds considerably when immersed, and loses noticeably in depth when boiled.
5. Colour loses considerably in depth when immersed, and is almost entirely stripped in boiling.

Fastness to Washing.

The patterns were treated for $\frac{1}{2}$ an hour with Soap solution of 140 and 212° F. (2 parts Olive Oil Soap per 1000). The figures refer in this case to loss of depth and change of shade; the staining of the soap bath and the bleeding into white was not taken into consideration.

1. Withstands washing at 212° F.
2. Withstands washing at 140° F.; loses slightly when treated at 212° F.
3. Colour loses slightly at 140° F., and considerably at 212° F.
4. Colour loses considerably at 140° F.
5. Colour loses very considerably at 140° F., and is stripped at the boil.

Fastness to Milling.

The patterns were plaited with white cotton and wool and then milled by hand with Soft Soap; the plaits were further immersed for 12 hours in Soap solution 1:100, in Soda solution of 3° Tw. and in water.

- | a) Change of shade. | b) Bleeding into white. |
|--|--|
| 1. Colour withstands any kind of milling. | 1. Colour does not bleed. |
| 2. Colour changes slightly in neutral or alkaline milling. | 2. Colour bleeds slightly. |
| 3. Colour changes noticeably in neutral or alkaline milling. | 3. Colour bleeds noticeably. |
| 4. Colour changes considerably and loses in depth. | 4. Colour bleeds considerably |
| 5. Colour is almost entirely stripped in milling. | 5. Colour bleeds considerably and changes its shade. |

Fastness to boiling Soda.

A hank of dyed yarn was boiled together with a white cotton hank in a Soda solution (2 parts Soda calcined per 1000) for $\frac{1}{2}$ an hour.

- | | |
|---|--|
| a) Change of Shade. | b) Bleeding into white |
| 1. Unchanged. | 1. Colour does not bleed. |
| 2. Slight loss of depth. | 2. Colour bleeds slightly. |
| 3. Noticeable loss of depth. | 3. Colour bleeds noticeably. |
| 4. Considerable loss of depth or change of shade. | 4. Colour bleeds considerably. |
| 5. Colour destroyed. | 5. Colour bleeds considerably and changes its shade. |

Fastness to boiling Acid (Cross Dyeing).

A hank of dyed yarn was boiled for 1 hour with equal weight of white cotton and wool yarn, in a bath which was prepared with 4% Sulphuric acid and 10% Glauber's salt (referring to the weight of the wool).

- | | |
|---|---|
| a) Change of shade. | b) Bleeding into white. |
| 1. Colour is unchanged. | 1. Colour does not bleed. |
| 2. Colour is slightly changed. | 2. Colour bleeds slightly. |
| 3. Colour is noticeably changed. | 3. Colour bleeds noticeably. |
| 4. Colour is changed or considerably stripped. | 4. Colour bleeds considerably. |
| 5. Colour is destroyed or the shade entirely changed. | 5. Colour bleeds almost entirely on to the wool hank. |

Acetic acid test.

In order to test the fastness of a colour to perspiration, a plait containing the dyed yarn and white cotton and wool, was treated for 1 hour in a bath which was prepared with 50 parts of Acetic acid 12° Tw. per 1000 parts of liquid at 104° F.

- | | |
|---|--|
| a) Change of shade. | b) Bleeding into white. |
| 1. Colour is unchanged. | 1. Colour does not bleed. |
| 2. Colour is slightly changed. | 2. Colour bleeds slightly. |
| 3. Colour is noticeably changed in shade and depth. | 3. Colour bleeds noticeably. |
| 4. Colour is considerably changed; equal to half its depth. | 4. Colour bleeds considerably. |
| 5. Colour is entirely changed or almost entirely stripped. | 5. Colour bleeds considerably and changes its shade. |

| Basic Dyestuffs | Method of Dyeing | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Change | | Bleeding | |
|-----------------------------|------------------|---------------------|---|---------------------|-----|-------------------|-----|--------------------|-----|-------------------|-----|----------------------|-----|-------------------|-----|---------------------|-----|---------------------|-----|-----------------------------|-----|-----------------------------|-----|--------|-----|----------|-----|
| | | TV | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2-3 | 1 | 4 | 3 | 2 | 1-2 | 1 | 1-2 | 1 | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Methylene Yellow H . . | TV | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2-3 | 1 | 4 | 3 | 2 | 1-2 | 1 | 1-2 | 1 | 1 |
| Auramine conc. . . . | TV | 2 | 2 | 4 | 2 | 3 | 2-3 | 3 | 3 | 2 | 2 | 4-3 | 2 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 1 | 5 | 5 | 1 | 2 | 1 | 1 | 1-2 | 1 |
| Flavophosphine 4G conc. new | TV | 2 | 2 | 1 | 3 | 2-3 | 3 | 2-3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 2 | 2-3 | 3 | 3 | 2 | 1-2 | 1-2 | 1-2 | 1-2 | 1-2 | 1 |
| Flavophosphine 2G conc. new | TV | 2 | 2 | 1 | 3-2 | 2 | 2-3 | 2 | 2-3 | 1 | 1 | 3 | 1-2 | 2-1 | 2 | 2 | 2 | 2-3 | 3-4 | 2-3 | 2-3 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 |
| Flavophosphine G conc. new | TV | 2 | 2 | 2 | 3-4 | 2-3 | 2-3 | 2-3 | 2-3 | 3 | 3 | 3-4 | 1 | 2 | 2-3 | 2 | 2 | 2-3 | 1 | 3-4 | 2 | 2 | 1-2 | 1-2 | 1 | 1-2 | 1 |
| Flavophosphine GR. . . . | TV | 2 | 2 | 2 | 3-4 | 4-5 | 3 | 3 | 3 | 3 | 3 | 3-4 | 1 | 2 | 2 | 2 | 2 | 1-2 | 3 | 2-3 | 2 | 1-2 | 2 | 2 | 1 | 1 | 1 |
| Flavophosphine R conc. new | TV | 2 | 2 | 2 | 4-3 | 2-3 | 3-4 | 2-3 | 3 | 3 | 3 | 3-4 | 1 | 2 | 3 | 3 | 3 | 2 | 3-4 | 2 | 2 | 2-3 | 1 | 2 | 1 | 1 | 1 |
| Azophosphine GO | TV | 2 | 2 | 2 | 3-2 | 3 | 1 | 3 | 3 | 1 | 1 | 4 | 1 | 2 | 3 | 2 | 2 | 2 | 4-5 | 3 | 3 | 2 | 1 | 1-2 | 1 | 1 | 1 |
| Azophosphine BRO | TV | 2 | 2 | 2 | 3-4 | 4-3 | 3 | 3 | 3 | 3 | 3 | 4-5 | 1-2 | 2-3 | 3 | 2-3 | 2-3 | 3 | 4-5 | 2 | 3 | 1 | 2-3 | 1 | 2-3 | 1 | 1 |
| Phosphine O | TV | 2 | 2 | 1 | 3 | 2-3 | 1 | 2-3 | 2-3 | 1 | 1 | 3-4 | 2-3 | 3-2 | 3-2 | 2-3 | 2-3 | 3 | 5 | 3 | 3 | 3 | 1-2 | 1-2 | 2 | 2 | 2 |
| Phosphine extra | TV | 2 | 2 | 1 | 3 | 2-3 | 1 | 2-3 | 2-3 | 1 | 1 | 3-4 | 2-3 | 3-2 | 3-2 | 2-3 | 2-3 | 5 | 3 | 3 | 3 | 1-2 | 1-2 | 2 | 2 | 2 | 2 |
| Yellow for Leather O . . . | TV | 2 | 2 | 1 | 3-4 | 4 | 3 | 2-1 | 3-4 | 2-1 | 2-1 | 3-4 | 2-3 | 3-4 | 3 | 3 | 3 | 4-5 | 3 | 4-5 | 3 | 4 | 2 | 3 | 2 | 2 | 2 |
| Chrysoidine A crystals . . | TV | 2 | 2 | 2 | 4 | 4 | 3 | 2-1 | 4 | 2-1 | 2-1 | 4 | 4-5 | 4-5 | 5 | 5 | 5 | 4-5 | 5 | 5 | 3 | 3-4 | 3 | 2 | 2-3 | 2-3 | 2-3 |
| Crysoidine C extra crystals | TV | 2 | 2 | 2 | 4 | 4 | 3 | 2-1 | 4 | 3 | 2-1 | 4 | 4-5 | 4-5 | 5 | 5 | 5 | 4-5 | 5 | 5 | 3 | 3-4 | 3 | 2 | 2-3 | 2-3 | 2-3 |
| Vesuvine extra yellow . . . | TV | 2-3 | 2 | 2 | 4 | 3-4 | 2 | 2 | 2 | 2 | 2 | 4-5 | 4 | 3 | 4-3 | 4 | 4 | 4-3 | 4 | 5 | 4 | 4 | 2 | 1-2 | 2 | 2 | 2 |

| Basic Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | Fastness to Chlorine | | Fastness to Washing | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | | |
|--|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|----------------------|-------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|-----|-----|
| | | | | | | | Muriatic acid | Acetic acid | | Change | Bleeding | Change | Bleeding | Change | Bleeding | | | |
| | | | | | | | | | | | | | | | | | | |
| Vesuvine conc. | TV | 2-3 | 2 | 4 | 2-3 | 2 | 2-1 | 4-5 | 3-4 | 3 | 3-4 | 4 | 4-5 | 4 | 1-2 | 2-1 | 1-2 | 1-2 |
| Vesuvine 2R | TV | 2-3 | 2 | 4 | 2-3 | 2 | 2-1 | 4-5 | 3-4 | 3 | 3-4 | 4 | 4-5 | 4 | 1-2 | 2 | 1-2 | 1-2 |
| Vesuvine 4BG conc. | TV | 2-3 | 2 | 4 | 2-3 | 2 | 2-1 | 4 | 3-4 | 3 | 3-4 | 4 | 4-5 | 4 | 1-2 | 2 | 1-2 | 1-2 |
| Cutch Brown G | TV | 2 | 2 | 4 | 3 | 3 | 2-1 | 4-5 | 4 | 4 | 4 | 3-4 | 4 | 4 | 3 | 3-2 | 2 | 2-3 |
| Cutch Brown D | TV | 2-3 | 2 | 4 | 3 | 3 | 1 | 4-5 | 4-5 | 5 | 5 | 4 | 4-5 | 4 | 2 | 1 | 1 | 1 |
| Dark Brown M | TV | 2-3 | 2 | 4 | 4 | 5 | 2 | 4 | 4 | 4 | 4 | 5 | 4-5 | 5 | 2 | 1 | 2 | 1 |
| Cerise G | TV | 3 | 1-2 | 4 | 4-5 | 4-5 | 1 | 3-4 | 2 | 2 | 3 | 3 | 5 | 3 | 3 | 3-2 | 2 | 2 |
| Grenadine O | TV | 3 | 1-2 | 4 | 4-5 | 4-5 | 1 | 4 | 2 | 2 | 3 | 3 | 5 | 3 | 3 | 2-3 | 2 | 2 |
| Grenadine RR | TV | 2 | 1-2 | 4 | 5-4 | 4-5 | 1-2 | 4 | 2-3 | 3-2 | 3 | 3 | 5 | 2 | 4-3 | 2-3 | 3-4 | 2-3 |
| Maroon O | TV | 3 | 1-2 | 4 | 4 | 4 | 1-2 | 4-5 | 2-3 | 2 | 3 | 2-3 | 4-5 | 2-3 | 3 | 2-3 | 2-3 | 2-3 |
| Magenta small crystals double ref. | TV | 3-2 | 2 | 4 | 5-4 | 5 | 1 | 4 | 2 | 2 | 3 | 3 | 5 | 2 | 3 | 2-3 | 2-3 | 2 |
| Magenta small crystals | TV | 3-2 | 2 | 4 | 5-4 | 5 | 1 | 4 | 2 | 2 | 3 | 3 | 5 | 2 | 3 | 2-3 | 2-3 | 2 |
| New Magenta O | TV | 3-2 | 2 | 4 | 5-4 | 5 | 1 | 4 | 2 | 2 | 3 | 3 | 5 | 2 | 3 | 2-3 | 2-3 | 2 |
| Methyl Violet 5R | TV | 2-3 | 1-2 | 4-5 | 3-4 | 5 | 1-2 | 4-5 | 3 | 3-2 | 3 | 3 | 4-5 | 3 | 3-4 | 2 | 2-3 | 2 |
| Methyl Violet 4R | TV | 2-3 | 1-2 | 4-5 | 3-4 | 5 | 1-2 | 4-5 | 3 | 3-2 | 3 | 3 | 4 | 2-3 | 3-4 | 2 | 2-3 | 2 |

| Basic Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | Fastness to Water | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|-----------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|-------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|----------|
| | | | | | | Muriatic acid | Acetic acid | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding |
| Methyl Violet 3R . . . | TV | 2-3 | 1-2 | 4-5 | 3-4 | 5 | 1-2 | 1-5 | 3 | 3-2 | 3 | 4 | 2-3 | 3-4 | 2 | 2-3 | 2 |
| Methyl Violet 2R . . . | TV | 2-3 | 1-2 | 4-5 | 3 | 5 | 1-2 | 4-5 | 3 | 3-2 | 3 | 4-3 | 2-3 | 3-4 | 2 | 2-3 | 2 |
| Methyl Violet B . . . | TV | 2-3 | 1-2 | 4-5 | 2-3 | 5 | 1-2 | 4-5 | 2-3 | 3-2 | 3-2 | 3 | 2-3 | 3 | 2 | 2 | 2 |
| Methyl Violet BB . . . | TV | 2 | 1-2 | 4-5 | 2-3 | 5-4 | 1 | 3 | 2 | 3-2 | 3-2 | 3 | 2-3 | 2-3 | 2 | 2 | 2 |
| Methyl Violet 4B . . . | TV | 2 | 1-2 | 4-5 | 3 | 5-4 | 1 | 3 | 2 | 3-2 | 3-2 | 3 | 2-3 | 2-3 | 2 | 2 | 2 |
| Methyl Violet 6B . . . | TV | 2 | 1-2 | 4-5 | 3-4 | 5-4 | 1 | 3 | 2 | 3-4 | 3-2 | 4 | 3 | 2-3 | 2 | 2 | 2 |
| Methyl Violet 8B superior . | TV | 2 | 1-2 | 4-5 | 3-4 | 5-4 | 1 | 3 | 2 | 2-3 | 2-3 | 4 | 3 | 2-3 | 2 | 2 | 2 |
| Violet Crystals O . . . | TV | 2 | 1-2 | 4-5 | 3-4 | 5-4 | 1 | 3 | 2 | 2 | 2-3 | 3 | 3 | 2-3 | 2 | 2 | 2 |
| Marine Blue DRX . . . | TV | 2 | 1-2 | 2-3 | 3 | 4 | 1 | 3 | 2 | 2 | 2-3 | 2-3 | 2-3 | 2-3 | 2 | 2 | 2-3 |
| Marine Blue BI . . . | TV | 2 | 1-2 | 3 | 3 | 4-5 | 1 | 3 | 2 | 2 | 2-3 | 3-4 | 3 | 2-3 | 1-2 | 2 | 1 |
| Marine Blue RI . . . | TV | 2 | 1-2 | 3 | 3 | 4-5 | 1 | 3 | 2 | 2 | 2-3 | 3 | 3 | 2-3 | 2-3 | 2 | 2-3 |
| Marine Blue D6R conc. . | TV | 2 | 1-2 | 3 | 3 | 4-5 | 1 | 3 | 2 | 2 | 2-3 | 2-3 | 3 | 2-3 | 2-3 | 2 | 2-3 |
| Rosolane BO . . . | TV | 2-1 | 2 | 2-3 | 2 | 3 | 1 | 3-4 | 2 | 2-1 | 2-3 | 2-3 | 2-3 | 2-1 | 2 | 1 | 1-2 |
| Methylene Violet BN powder | TV | 3-2 | 2 | 3 | 3-4 | 3-4 | 1 | 3-4 | 2 | 2 | 3 | 2-3 | 2 | 2 | 1 | 1-2 | 1 |
| Methylene Heliotrope O . | TV | 2-1 | 2 | 2-3 | 2 | 3 | 1 | 3-4 | 2 | 2-1 | 2-3 | 2-3 | 3 | 2-1 | 2 | 1 | 1-2 |

| Basic Dyestuffs | Method of Dyeing | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|-----------------------------|------------------|---------------------|----------|---------------------|----------|-------------------|----------|--------------------|----------|-------------------|----------|----------------------|----------|-------------------|----------|---------------------|----------|-----------------------------|----------|-----------------------------|--------|------------------|--------|
| | | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
| | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Change | Bleeding | Change |
| Methylene Violet RRN powder | TV | 2 | 2 | 2 | 2 | 3-2 | 2 | 2 | 2 | 4 | 1 | 3-4 | 2 | 2 | 2 | 2-3 | 2 | 3 | 3-4 | 2-1 | 2 | 1 | 1-2 |
| Methylene Violet RRA powder | TV | 2 | 2 | 2 | 2 | 3-2 | 2 | 2 | 2 | 4 | 1 | 3-4 | 2 | 2 | 2 | 2-3 | 2 | 3 | 3-4 | 2-1 | 2 | 1 | 1-2 |
| Methylene Violet 3RA extra | TV | 2 | 2 | 2 | 2 | 3-2 | 2 | 2 | 2 | 4 | 1 | 3-4 | 2 | 2 | 2 | 2-3 | 2 | 3 | 3-4 | 2-1 | 2 | 1 | 1-2 |
| Primula R soluble in water | TV | 2 | 2 | 2 | 2 | 3-4 | 2 | 3-4 | 2 | 5 | 1 | 3-4 | 2 | 2 | 2 | 2-3 | 2 | 4 | 1-2 | 3 | 1-2 | 2-3 | 3 |
| Safranine B conc. bluish. | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine conc. | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine AN extra | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine O | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine T extra | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine Nr. 104 | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine GGS | TV | 2 | 2 | 1-2 | 2 | 3 | 2-3 | 2-3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 3-2 | 3 | 2 | 2-1 | 1-2 | 2 |
| Safranine Scarlet 2G | TV | 2 | 2 | 1-2 | 2 | 3 | 3 | 3 | 2 | 5 | 1 | 4 | 2 | 2 | 2 | 2-3 | 2 | 4 | 3 | 3 | 2 | 2 | 2 |
| Safranine Scarlet Nr. 5249 | TV | 2 | 2 | 1-2 | 2 | 3 | 2 | 2 | 2 | 4 | 1 | 4-3 | 2 | 2-3 | 2 | 3 | 2-3 | 2-3 | 2 | 2-3 | 2 | 2 | 1-2 |
| Rosazaine Scarlet G extra | TV | 1-2 | 1 | 3-4 | 4 | 1-2 | 4 | 1-2 | 1 | 1-2 | 1 | 3-4 | 1 | 2 | 3 | 2-1 | 2 | 5 | 2 | 2 | 1 | 1 | 1 |
| Rosazaine 6G | TV | 2 | 2 | 2-3 | 3-4 | 1-2 | 1-2 | 1-2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 3-2 | 2-3 | 2 | 2 | 1 | 1 |

| Basic Dyestuffs | Method of Dyeing | Fastness to Rubbing | | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|--------------------------|------------------|---------------------|-----|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|-----|-------------------|-----|---------------------|----------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|-----|
| | | 2 | 2-3 | | | | Muriatic acid | Acetic acid | 3 | 2 | 2 | 2-1 | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | |
| Rosazaine 6GD | TV | 2 | 2-3 | 3-4 | 1-2 | 2 | 1 | | 3 | 2 | 2 | 2 | 2 | 2-1 | 2 | 3-4 | 3-2 | 2-3 | 2 | 2 | 1 | 1 |
| Rosazaine 4G | TV | 2 | 2 | 3-4 | 1-2 | 2 | 1 | | 3-4 | 2-1 | 2-1 | 2 | 2-1 | 2-1 | 2 | 3 | 4-5 | 3 | 2 | 2 | 1 | 1-2 |
| Rosazaine extra | TV | 2 | 2 | 3-4 | 2 | 2-3 | 1 | | 3-4 | 3 | 3-4 | 3 | 3-4 | 3 | 3 | 4 | 5 | 3 | 2 | 3 | 1 | 3-2 |
| Rosazaine G | TV | 2 | 2 | 3-4 | 2 | 2-3 | 1 | | 4-3 | 3 | 3-4 | 3 | 3-4 | 3 | 3 | 3 | 5 | 3 | 2 | 3 | 1 | 3-2 |
| Rosazaine B | TV | 2 | 2 | 3-4 | 2 | 2-3 | 1 | | 3 | 3 | 3-4 | 3 | 3-4 | 3 | 4 | 5 | 3 | 2 | 3 | 1 | 3 | 3 |
| Thionine Blue GO | TV | 1-2 | 2 | 2 | 3-4 | 2 | 1 | | 3 | 2 | 2-1 | 2 | 2-1 | 2 | 2-1 | 2 | 4 | 4 | 2 | 2 | 1-2 | 1-2 |
| Methylene Blue BB extra | TV | 1-2 | 2 | 2 | 3 | 2 | 1 | | 3 | 2 | 2-1 | 2 | 2-1 | 2 | 2 | 3 | 4 | 4 | 2-3 | 2-3 | 2 | 2 |
| Methylene Blue DBB extra | TV | 1-2 | 2 | 2 | 3 | 2 | 1 | | 3 | 2 | 2-1 | 2 | 2-1 | 2 | 2 | 3 | 4 | 4 | 2-3 | 2-3 | 2 | 2 |
| Methylene Blue B conc. | TV | 1-2 | 2 | 2 | 3 | 2 | 1 | | 3 | 2 | 2-1 | 2 | 2-1 | 2 | 2 | 3 | 4 | 4 | 2-3 | 2-3 | 2 | 2 |
| Methylene Blue R conc. | TV | 2 | 1-2 | 2 | 3 | 4 | 1 | | 3-4 | 2 | 2 | 2 | 2 | 2-3 | 2-3 | 2 | 4 | 4 | 3 | 2-3 | 2 | 2 |
| Methylene Blue D2R | TV | 2 | 1-2 | 2-3 | 3-4 | 4 | 1 | | 3-4 | 2 | 2 | 2 | 2 | 2-3 | 2-3 | 2 | 3 | 3 | 2-3 | 2 | 2 | 2 |
| Methylene Blue 3R | TV | 2 | 1-2 | 3 | 3-4 | 4-5 | 1 | | 3-4 | 2 | 2 | 2 | 2 | 2-3 | 2-3 | 2 | 3 | 3 | 2-3 | 2-3 | 2 | 2 |
| Methylene Green GG | TV | 2 | 1 | 2-1 | 3 | 1 | 1 | | 3 | 2 | 2 | 2 | 2 | 2-3 | 2 | 2 | 4 | 4 | 1-2 | 2 | 1 | 1-2 |
| Methylene Green extra | TV | 2 | 1 | 2-1 | 3 | 1 | 1 | | 3 | 2 | 2 | 2 | 2 | 2-3 | 2 | 2 | 4 | 4 | 1-2 | 2 | 1 | 1-2 |
| yellow DG | TV | 2 | 1 | 2-1 | 3 | 1 | 1 | | 3 | 2 | 2 | 2 | 2 | 2-3 | 2 | 2 | 4 | 4 | 1-2 | 2 | 1 | 1-2 |
| Methylene Green extra | TV | 2 | 1 | 2-1 | 3 | 1 | 1 | | 3 | 2 | 2 | 2 | 2 | 2-3 | 2 | 2 | 4 | 4 | 1-2 | 2 | 1 | 1-2 |
| yellow conc. | TV | 2 | 1 | 2-1 | 3 | 1 | 1 | | 3 | 2 | 2 | 2 | 2 | 2-3 | 2 | 2 | 4 | 4 | 1-2 | 2 | 1 | 1-2 |

| Basic Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | Fastness to Chlorine | Fastness to Water | Fastness to Washing | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test |
|------------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|----------------------|-------------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|
| | | | | | | | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | |
| New Ethyl Blue BS. | TV | 2 | 1-2 | 2 | 2-3 | 2 | 2-1 | 4-5 | 2 | 2-3 | 2 | 3-2 | 2 | 2 | 2 | 2 |
| Ethyl Blue BF. | TV | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2-3 | 2 | 1-2 | 2 | 1-2 |
| New Ethyl Blue RS. | TV | 2 | 1-2 | 2-3 | 2-3 | 3 | 3 | 4-5 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| Indamine Blue N extra powder | TV | 2 | 1-2 | 2-3 | 2-3 | 2 | 1 | 4 | 1-2 | 2 | 2-3 | 3 | 2-3 | 2 | 1-2 | 1 |
| Indamine Blue R powder | TV | 2 | 1-2 | 2-3 | 3 | 1 | 1 | 4-3 | 1-2 | 2 | 2-3 | 3 | 2 | 2 | 1-2 | 1 |
| Methylene Grey ND. | TV | 1-2 | 2 | 2 | 3-4 | 2 | 1-2 | 4 | 1-2 | 2 | 3 | 4 | 3 | 3 | 2 | 2-1 |
| Methylene Grey NFD | TV | 1-2 | 2 | 3 | 3-4 | 1-2 | 1-2 | 4-5 | 2 | 2 | 3 | 4 | 3 | 4 | 2-3 | 2 |
| Methylene Grey O. | TV | 1-2 | 2 | 2 | 3 | 2 | 1-2 | 4 | 2-1 | 2 | 3-4 | 4 | 3 | 3 | 2 | 2 |
| Methylene Grey NFS | TV | 1-2 | 2 | 3 | 3 | 1-2 | 1 | 4 | 2-1 | 2-3 | 3-4 | 4 | 3 | 3 | 2-3 | 2 |
| Silk Grey O, fast to water | TV | 2 | 2 | 3 | 5 | 3 | 1 | 4-5 | 1 | 2-3 | 4 | 3 | 1-2 | 4 | 1-2 | 1-2 |
| Conc. Cotton Blue R. | TV | 2 | 2 | 3-4 | 5 | 2 | 1 | 4 | 4-3 | 5-4 | 5-4 | 3 | 5 | 1 | 5-4 | 2-3 |
| Conc. Cotton Blue Nr. 1. | TV | 2 | 2 | 3-4 | 5 | 1-2 | 1 | 4 | 4-3 | 5-4 | 5-4 | 3 | 5 | 1 | 5-4 | 2-3 |
| Conc. Cotton Blue Nr. 2. | TV | 2 | 2 | 3-4 | 5 | 1-2 | 1 | 4 | 4-3 | 5-4 | 5-4 | 3 | 5 | 1 | 5-4 | 2-3 |
| Pure Blue O. | TV | 2 | 1 | 3-4 | 5 | 1-2 | 1 | 4 | 4-3 | 5-4 | 5-4 | 3 | 5 | 1-2 | 5-4 | 2-3 |
| Cotton Blue extra | TV | 2 | 1 | 3-4 | 5 | 1-2 | 1 | 4 | 4-3 | 5-4 | 5-4 | 3 | 5 | 1-2 | 5-4 | 2-3 |

| Direct Dyestuffs | Method of Dyeing | Fastness to Rubbing | | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Washing | | Fastness to Milling | | Fastness to Soda | | Fastness to boiling in Acid | | Acetic acid test | | |
|---------------------------------|------------------|---------------------|-----|-------------------|--------------------|---------------|--------------------|----------------------|-------------------|-------------------|----------------------|---------------------|-------------------|--------|---------------------|--------|---------------------|--------|------------------|--------|-----------------------------|--------|------------------|--------|-----|
| | | Fastness to Ironing | | Fastness to Light | Fastness to Alkali | Muriatic acid | Acetic acid | Fastness to Chlorine | | Fastness to Water | | Fastness to Washing | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | |
| Primuline O | D | 1-2 | 2 | 5 | 2-1 | 4 | 3 | *) | 3 | 2-3 | 1-2 | 2-3 | 2 | 3 | 2 | 3 | 2-3 | 2 | 3 | 2 | 3 | 2-3 | 2 | 3-2 | 1-2 |
| Primuline O | Cl | 1-2 | 2 | 1 | 1-2 | 1 | 1 | 1 | 2-1 | 1 | 1 | 3 | 1-2 | 2 | 1-2 | 2 | 1-2 | 2 | 3 | 2 | 2 | 1-2 | 2 | 1-2 | 1 |
| Primuline O | N | 1-2 | 2 | 4-5 | 1 | 2-1 | 1 | 3-4 | 2 | 2 | 1-2 | 2 | 1-2 | 3 | 2 | 1-2 | 2 | 3 | 2 | 2 | 2 | 1-2 | 2 | 1-2 | 1 |
| Dianil Yellow 3G | D | 1 | 1 | 4 | 2-3 | 2 | 1-2 | 4 | 3 | 4 | 2 | 4 | 2 | 3 | 4 | 4 | 3-4 | 2 | 4 | 4 | 4 | 2-3 | 3 | 2-3 | 2 |
| Dianil Yellow 3G. | K | 1 | 1-2 | 3 | 2-3 | 1 | 1 | 4 | 2-3 | 3-4 | 3 | 3 | 3 | 3 | 2-3 | 2 | 3-2 | 2 | 3 | 3 | 3 | 3 | 3 | 2-3 | 2 |
| Dianil Pure Yellow HS | D | 1 | 2 | 4-5 | 2 | 4 | 3 | 3 | 3 | 2-3 | 2 | 3-2 | 2 | 3 | 2-3 | 2 | 3-2 | 2 | 3 | 3 | 3 | 3 | 3 | 2-3 | 2 |
| Dianil Yellow GC | D | 1 | 1 | 5 | 2 | 3-4 | 3 | 5 | 4 | 3-4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 5 | 2 | 4 | 2 | 2 |
| Oxydianil Yellow G | D | 1 | 2-1 | 1 | 2-1 | 2 | 1 | 1 | 4 | 3-4 | 1-2 | 3 | 3 | 4 | 1 | 4 | 3-4 | 1-2 | 3 | 4 | 3 | 4 | 1 | 2-3 | 2 |
| Oxydianil Yellow O | D | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3-4 | 3-4 | 1-2 | 3 | 2 | 3 | 3 | 2-3 | 3-4 | 1-2 | 3 | 4 | 2-3 | 4 | 1-2 | 2-1 | 2 |
| Cresotine Yellow G | D | 1-2 | 2 | 3 | 3-4 | 4 | 3 | 5-4 | 3 | 3 | 3 | 2 | 3 | 4 | 4 | 3-4 | 4 | 3 | 4 | 3 | 4 | 1 | 3-2 | 1 | 1 |
| Aurophenine O | D | 1-2 | 2-1 | 2-1 | 1-2 | 5 | 3-4 | 1 | 4 | 4-5 | 2 | 3-4 | 5 | 4 | 4 | 4-5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Dianil Yellow R | D | 1-2 | 2-1 | 2 | 2 | 1-2 | 1 | 4-3 | 3-4 | 4-3 | 1-2 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 2-3 | 4 | 2 | 3-2 | 2 |
| Dianil Yellow 2R | D | 1 | 2 | 2 | 2 | 1 | 1 | 4-3 | 3-4 | 3-4 | 1-2 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 2-3 | 4 | 2 | 3 | 3 |

| Direct Dyestuffs | Method of Dyeing | Fastness to Rubbing | | | Fastness to Ironing | | | Fastness to Light | | | Fastness to Alkali | | | Fastness to Acids | | Fastness to Chlorine | | | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | 3-4 | 2-3 | 1-2 | 3-4 | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | 3-4 | 1-2 | 2-3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Dianil Direct Yellow S . . . | D | 1-2 | 1-2 | 2-3 | 3-4 | 2-3 | 1 | 1 | 3-4 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2- |

| Direct Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Light | Fastness to Alkali | Fastness to Acids | Fastness to Chlorine | Fastness to Water | Fastness to Washing | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test |
|--------------------------|------------------|---------------------|-------------------|--------------------|-------------------|----------------------|-------------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|
| | | | | | Muturic acid | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | |
| Dianil Japonine G . . . | K | 2 | 1-2 2-3 | 3 | 3 | 5 | 2 | 3-4 | 2 | 2-3 | 3-4 | 3-4 | 3-4 | 2-1 | 3 1 |
| Dianil Japonine G . . . | KCl | 2 | 1-2 3 | 3 | 5 | 5 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 1 | 4-3 1 |
| Dianil Brown 3R . . . | D | 2 | 3 3-4 | 3 | 5-4 | 5 | 4 | 3 | 3-2 | 3 | 4-3 | 4 | 3 | 4-5 | 2 2-3 |
| Dianil Brown R . . . | D | 2 | 2-3 3-4 | 2-1 | 2 1-2 | 5 | 3-2 | 3 | 2 | 3 | 4 | 4 | 3 | 3 | 2-3 1-2 |
| Dianil Brown R . . . | Az | 2 | 2-3 3-4 | 2 | 2 1-2 | 5 | 2 | 2 | 2 | 2-3 | 2-3 | 3 | 2 | 2 | 2-1 1 |
| Dianil Brown MH . . . | D | 2 | 4 3 | 2 | 3 2-3 | 5 | 4 | 3 | 2 | 3-4 | 3-4 | 4 | 3-4 | 3-4 | 3 1 |
| Dianil Brown MH . . . | KCl | 2 | 2 2 2-1 | 3 | 2 | 5 | 2-3 | 2 | 1-2 | 2 | 2-3 | 3-4 | 3-2 | 3 | 2 2-1 |
| Dianil Brown MH . . . | N | 2 | 3 4 | 2 | 2 1 | 5 | 3 | 3 | 2 | 3 | 3-4 | 4 | 2 | 2 | 2 1 |
| Dianil Brown MH . . . | Phd | 1 | 3 4-5 | 2-1 | 2-3 | 1 | 3 | 3 | 2-1 | 2-3 | 3 | 4 | 1-2 | 3-2 | 1-2 1-2 |
| Dianil Brown X . . . | D | 2 | 2 3-4 | 2-3 | 2-3 | 2 | 4-3 | 3 | 2 | 3 | 3-4 | 4 | 2 | 2 | 2 1-2 |
| Dianil Brown G . . . | D | 2 | 3 3-4 | 3 | 2 1 | 5-4 | 3-4 | 3 | 2-3 | 3 | 4 | 4 | 3 | 2-1 | 2 1 |
| Dianil Brown M . . . | D | 2 | 3-2 4-3 | 2 | 2 1 | 5-4 | 4-3 | 3 | 2 | 3 | 4-3 | 4 | 2 | 3 | 2 1 |
| Dianil Brown M . . . | Az | 2 | 2 3-4 | 2-1 | 2 1 | 4-5 | 2-2-1 | 2 | 2 | 2 | 2 | 3-4 | 2 | 1-2 | 2-1 1 |
| Dianil Fast Brown GR . . | D | 2 | 1-2 2-3 | 2 | 4 2 | 4-5 | 4 | 4 | 2 | 3-4 | 4 | 4 | 4-3 | 3-4 | 3-4 1-2 |
| Dianil Fast Brown 3R . . | D | 2-1 | 2 2-3 | 2 | 3 2 | 5-4 | 4 | 3 | 2 | 3-4 | 3-4 | 4 | 3 | 3-4 | 2 1 |
| Dianil Fast Brown 2G . . | D | 2-1 | 1-2 2-3 | 2 | 3-4 2 | 4 | 4-3-4-3 | 2 | 2 | 3 | 4 | 4 | 3 | 3-4 | 2 1-2 |

| Direct Dyestuffs | Method of Dyeing | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|----------------------------|------------------|---------------------|-----|---------------------|-----|-------------------|---|--------------------|-----|-------------------|-----|----------------------|-----|---------------------|---|---------------------|-----|-----------------------------|-----|-----------------------------|-----|------------------|--|
| | | Change | | Bleeding | | Change | | Change | | Change | | Change | | Change | | Change | | Change | | Change | | Change | |
| Dianil Fast Brown B . . | D | 2 | 2-1 | 3-4 | 2 | 2 | 3 | 2 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3-2 | 4 | 3-2 | 2 | 2 | 1 | |
| Dianil Fast Brown B . . | KCr | 2 | 2-1 | 3 | 2-3 | 3 | 3 | 2 | 5 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 1-2 | |
| Dianil Chrome Brown G . . | D | 2 | 2-1 | 2 | 2 | 2 | 3 | 2 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3-2 | 3 | 3-2 | 2 | 2 | 1 | |
| Dianil Chrome Brown R . . | D | 2 | 2 | 4 | 1-2 | 3 | 3 | 2 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 1-2 | 3 | 3-4 | 4 | 2-3 | 1 | 2-3 | |
| Dianil Chrome Brown R . . | KCr | 2 | 1 | 3-2 | 2 | 3 | 3 | 2 | 5 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1-2 | 1-2 | 2 | 2 | 1 | 2 | |
| Dianil Brown BD | D | 2 | 2 | 3-4 | 2 | 2 | 2 | 1 | 5-4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2-3 | 3-4 | 4-3 | 1 | 1-2 | 1 | |
| Dianil Brown BD | Az | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 5 | 2-3 | 3 | 2 | 2 | 2 | 2 | 2 | 2-3 | 4 | 4 | 2-1 | 2-3 | 1 | |
| Dianil Brown D | D | 2 | 2-1 | 3-2 | 2-1 | 2 | 2 | 1 | 5 | 1 | 2-1 | 2 | 2 | 2 | 2 | 2 | 2-1 | 2 | 2 | 2 | 1 | 1 | |
| Dianil Brown D | Az | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 5 | 3-4 | 4 | 3-4 | 1-2 | 3 | 3 | 3 | 3 | 3 | 4 | 4-5 | 4 | 2-3 | |
| Dianil Red 4B | D | 2 | 2 | 4 | 1 | 5 | 5 | 3-4 | 4-3 | 4 | 3-4 | 1-2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4-5 | 4 | 2-3 | |
| Brilliant Dianil Red R . . | D | 2 | 2 | 4 | 2 | 5 | 5 | 2 | 5 | 4 | 3-4 | 2 | 3-4 | 2 | 3 | 3 | 3 | 4 | 4 | 4-5 | 4 | 3 | |
| Dianil Red R | D | 2 | 2 | 4-5 | 2 | 5 | 5 | 4 | 4-5 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4-5 | 5 | 2 | 1 | |
| Delta Purpurine 5B | D | 1-2 | 2-1 | 4 | 2 | 5 | 5 | 2 | 5 | 4 | 3-4 | 1-2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | |

| Substantive Colours | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | Fastness to Chlorine | | Fastness to Water | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|------------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|----------------------|-------------|-------------------|---------------------|----------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|-----|
| | | | | | | | Muriatic acid | Acetic acid | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | | |
| Dianil Fast Scarlet RS extra | D | 1-2 | 2 | 2-3 | 1-2 | 3 | 2 | 3-4 | 3-4 | 3-4 | 3-4 | 2 | 3 | 3 | 3 | 3-4 | 4 | 1-2 | 2 |
| Dianil Fast Scarlet 4BL | D | 1-2 | 3 | 4 | 2 | 1-2 | 1 | 3-4 | 4-3 | 3-4 | 3-4 | 2 | 3 | 3 | 3 | 3-4 | 3-4 | 2 | 3 |
| Dianil Fast Scarlet 4BS | D | 1-2 | 2-3 | 1-2 | 3-3 | 3 | 3 | 3-4 | 3-4 | 3-4 | 3-4 | 2 | 3 | 3 | 3 | 2-3 | 4 | 1-2 | 2 |
| Dianil Fast Scarlet 6BS | D | 1-2 | 2 | 2-3 | 1-2 | 3 | 2 | 3-4 | 3-4 | 3-4 | 3-4 | 2 | 3 | 3 | 3 | 2-3 | 4 | 1-2 | 2 |
| Dianil Fast Scarlet 8BS | D | 1-2 | 2 | 3-4 | 1-2 | 3 | 2 | 3-4 | 3-4 | 3-4 | 3-4 | 2 | 3 | 3 | 3 | 2-3 | 4 | 1-2 | 2 |
| Diazanil Scarlet G | N | 2-1 | 3 | 3 | 1 | 2-1 | 1 | 3-4 | 2-3 | 2 | 2 | 2 | 2 | 2 | 3-4 | 3 | 2 | 1 | 1-2 |
| Diazanil Scarlet B | N | 2-1 | 3 | 3 | 1 | 2-1 | 1 | 3-2 | 2-3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 1 | 1-2 |
| Diazanil Scarlet 6B | N | 2-1 | 3 | 3 | 1 | 2-1 | 1 | 3-2 | 2-3 | 2-3 | 2-3 | 2 | 2 | 2 | 3 | 2 | 3 | 1 | 1-2 |
| Dianil Scarlet 2R | D | 2 | 4 | 2-1 | 5 | 2 | 2-3 | 2-3 | 5-4 | 5-4 | 5-4 | 3-2 | 4 | 4-5 | 4 | 4-5 | 4-5 | 4 | 4 |
| Dianil Scarlet 2R | S | 2 | 2-1 | 5 | 2 | 2-3 | 1-2 | 2-3 | 2-3 | 4-5 | 2-3 | 4 | 4 | 4-5 | 4 | 1-2 | 1-2 | 1-2 | 2 |
| Dianil Pink BD | D | 1-2 | 2-3 | 3-2 | 2 | 3 | 2 | 4 | 4-5 | 4-5 | 2-3 | 4 | 4-5 | 3 | 3 | 4-5 | 4-5 | 4-5 | 4 |
| Dianil Red 10B | D | 2 | 3 | 4 | 1-2 | 5 | 4 | 4 | 3-4 | 1-2 | 1-2 | 3 | 3 | 3 | 4 | 4-5 | 3-4 | 5 | 1-2 |
| Dianil Fast Red PH | D | 1-2 | 1-2 | 2-3 | 2-1 | 4 | 2-1 | 5 | 4 | 4 | 2 | 3-4 | 2 | 4 | 4 | 4-3 | 2-3 | 3 | 1-2 |
| Dianil Crimson G | D | 2 | 2-3 | 3 | 2-3 | 5 | 1 | 5-4 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 5-4 | 4 | 2 | 3-2 |
| Dianil Crimson B | D | 2-1 | 2 | 2-3 | 2-3 | 5 | 1 | 4-5 | 4-5 | 4 | 4 | 2 | 4-3 | 4 | 4 | 5-4 | 4 | 2 | 3-2 |
| Dianil Claret Red G | D | 2 | 3 | 3 | 2-3 | 4-5 | 3-4 | 5 | 4-3 | 3-4 | 2 | 4 | 4 | 4 | 4 | 5 | 4-3 | 5 | 2 |
| Dianil Claret Red B | D | 2 | 3 | 3 | 2-3 | 4-5 | 1-2 | 5 | 4-3 | 3-4 | 2-3 | 4-3 | 4 | 4 | 4 | 4-3 | 4 | 3-2 | 2 |
| Dianil Violet H | D | 2 | 3 | 3 | 2 | 4-5 | 2 | 5 | 4 | 3 | 2 | 3 | 4-3 | 4 | 4 | 4 | 4 | 4 | 1-2 |
| Dianil Blue H6G | D | 1 | 2 | 4-5 | 1-2 | 1 | 1 | 4-5 | 4-3 | 3-4 | 1-2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3-4 |
| Dianil Blue H3G | D | 1 | 2-3 | 3-4 | 1-2 | 3 | 2-1 | 4-5 | 4 | 3-4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3-2 |

| Substantive Colours | | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | Fastness to Water | Fastness to Washing | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|----------------------------|---|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|-------------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|-----|
| | | | | | | | Muriatic acid | Acetic acid | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | | |
| Dianil Green BBN | . | D | 1 | 2-3 | 3-4 | 3-4 | 3 | 1 | 5 | 5 | 5 | 3 | 3 | 4 | 3-4 | 3 | 4-5 | 2-1 | 1-2 |
| Dianil Green BB | . | D | 1 | 2-3 | 3-4 | 3-4 | 3-4 | 1 | 5 | 5 | 5 | 3 | 3 | 4 | 3-4 | 3 | 4-5 | 2-1 | 1-2 |
| Dianil Green BN | . | D | 1 | 2-3 | 3-4 | 3-4 | 3 | 1 | 5 | 5 | 5 | 3 | 3 | 4 | 3-4 | 3 | 4-5 | 2-1 | 1-2 |
| Dianil Green B | . | D | 1 | 2-3 | 3-4 | 3-4 | 3-4 | 1 | 5 | 5 | 5 | 3 | 3 | 4 | 3-4 | 3 | 4-5 | 2-1 | 1-2 |
| Dianil Green GN | . | D | 1 | 2-3 | 3-4 | 3-2 | 3-4 | 1 | 5 | 5 | 5 | 3 | 3 | 4 | 3-4 | 3 | 4-5 | 2-1 | 1-2 |
| Dianil Green G | . | D | 1 | 2 | 4 | 3-2 | 2-3 | 1 | 5 | 5 | 5 | 3 | 3 | 4 | 3-4 | 3 | 4-5 | 2-1 | 1-2 |
| Dianil Fast Olive Green 2G | . | D | 2-1 | 1-2 | 3-4 | 2 | 2 | 1 | 4-5 | 4 | 4 | 2 | 3 | 4 | 4 | 4-3 | 3-4 | 2 | 1-2 |
| Dianil Dark Green B | . | D | 1 | 2 | 3-4 | 2-1 | 3-2 | 1 | 4-5 | 4 | 2-3 | 1-2 | 3-4 | 2-3 | 3 | 3 | 4-5 | 2 | 2 |
| Dianil Black ES | . | D | 2 | 2-1 | 3 | 1-2 | 3 | 2 | 4-5 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| Dianil Black ES | . | N | 2 | 1-2 | 3-4 | 2-1 | 2 | 2 | 4 | 2-3 | 2 | 1 | 2-3 | 1-2 | 3-4 | 1-2 | 3 | 1-2 | 2-3 |
| Dianil Black ES | . | Phd | 2 | 1-2 | 3-2 | 2-1 | 1 | 1 | 4-5 | 2 | 2 | 1-2 | 3 | 4 | 4 | 1-2 | 3 | 1 | 1-2 |
| Dianil Black G | . | D | 2 | 2-1 | 3-4 | 3-4 | 3 | 3 | 5 | 4 | 4-3 | 2 | 4-3 | 4 | 4 | 3 | 3 | 3-2 | 2 |
| Dianil Black CR | . | D | 2 | 2 | 3 | 2-3 | 2 | 2 | 4-5 | 4-3 | 4-3 | 2 | 4-3 | 4 | 4 | 2 | 4 | 2-1 | 3 |
| Dianil Black CR | . | KCr | 2 | 2-1 | 3 | 2-3 | 2 | 2 | 5-4 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3-4 | 2 | 2 |
| Dianil Black CR | . | Az | 2 | 1-2 | 4 | 2-3 | 2 | 1 | 4-5 | 2 | 2 | 2-1 | 3 | 2 | 3-4 | 2 | 3-4 | 2-1 | 1-2 |
| Dianil Black R | . | D | 2 | 1-2 | 3 | 2 | 2 | 2 | 4-5 | 4 | 3 | 2 | 4 | 4 | 4 | 2-3 | 2 | 2-1 | 1 |
| Dianil Black R | . | Az | 2 | 1-2 | 3 | 2 | 1-2 | 1-2 | 4-5 | 1-2 | 2-1 | 2 | 4 | 2-3 | 4 | 2-1 | 2 | 1-2 | 1 |

| Substantive Colours | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | Fastness to Water | Fastness to Washing | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test |
|---|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|-------------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|
| | | | | | | Muriatic acid | Acetic acid | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change |
| Dianil Black CB | D | 2 | 1-2 4-3 | 2 | 2 | 2 | 2-3 | 5-4 | 4 | 4 | 2 | 3 | 4 | 4 | 2-3 | 3 | 2 |
| Dianil Black CB | KCr | 2 | 1-2 3-2 | 2 | 2-3 | 3 | 2-3 | 5 | 3 | 3 | 1-2 | 3 | 3-4 | 4 | 3 | 3 | 3 |
| Dianil Black T. | D | 2 | 2 2-3 | 2 | 2-3 | 2-3 | 2-3 | 4 | 3 | 3-2 | 2 | 3-4 | 4 | 2 | 2-3 | 2 | 1-2 |
| Dianil Black T. | Cr | 2-1 | 2-1 3 | 3 | 2-3 | 2 | 2 | 4-5 | 2-1 | 2-1 | 2 | 2 | 2 | 1 | 1-2 | 1 | 1 |
| Dianil Black N | D | 2 | 2-1 2 | 2 | 2 | 2 | 2 | 4-5 | 4-3 | 3 | 2 | 4 | 4 | 2-3 | 2 | 2 | 1-2 |
| Dianil Black N | K | 2 | 1-2 1-2 | 2 | 2 | 2-3 | 2 | 5 | 1 | 2-1 | 1-2 | 2-3 | 3 | 4 | 2 | 3-2 | 1 |
| Dianil Black N | Az | 2 | 1-2 2-3 | 2 | 2 | 1 | 1 | 4-5 | 1-2 | 2 | 2 | 4 | 2 | 4 | 1-2 | 3 | 1-2 |
| Dianil Black PR | D | 2 | 2 4-5 | 2-3 | 2-3 | 2-1 | 2-1 | 5 | 3-4 | 3 | 2-1 | 3 | 4-3 | 4 | 1 | 2-3 | 1 |
| Dianil Black PR | Az | 2 | 2 3-4 | 2 | 2 | 1 | 1 | 5-4 | 2 | 2 | 1-2 | 2 | 2 | 4-3 | 2 | 2 | 1-2 |
| Patent Dianil Black FF conc. | D | 2 | 1-2 3-4 | 2 | 2 | 2 | 2 | 4 | 4 | 3-4 | 2 | 4-3 | 4 | 4 | 2-3 | 2 | 1 |
| Patent Dianil Black FFC conc. | D | 2 | 1-2 3-4 | 2 | 2 | 2 | 2 | 4 | 4 | 3-4 | 2 | 4-3 | 4 | 4 | 2-3 | 2 | 1 |
| Patent Dianil Black EF conc. | D | 2 | 1-2 3-4 | 2-3 | 2-3 | 2-3 | 2-3 | 4 | 4 | 3-4 | 2 | 4-3 | 4 | 4 | 2-3 | 3 | 1 |
| Patent Dianil Black FFA extra conc. | D | 2 | 2-1 3-4 | 2 | 2 | 2 | 2 | 4 | 4 | 3-4 | 2 | 4-3 | 4 | 4 | 2-3 | 2 | 1 |
| Patent Dianil Black RW extra | D | 2 | 1-2 3-4 | 2 | 2 | 2 | 2 | 4 | 4 | 3-4 | 2 | 4-3 | 4 | 4 | 2-3 | 2 | 1 |
| Patent Dianil Black EB conc. | D | 2 | 2 3 | 3 | 3 | 3 | 3 | 5-4 | 4 | 4-3 | 2-3 | 3 | 4 | 4 | 2-3 | 3 | 1-2 |
| Patent Dianil Black FB | D | 2 | 1-2 3-4 | 2 | 2 | 2 | 2 | 4 | 4 | 3 | 2 | 3 | 4 | 4 | 2 | 3 | 1 |

| Sulphur Dyestuffs | Method of Dyeing | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | | | |
|--------------------------------|------------------|---------------------|---|---------------------|-----|-------------------|---|--------------------|-----|-------------------|-----|----------------------|-----|-------------------|-----|---------------------|---|---------------------|---|-----------------------------|-----|-----------------------------|---|------------------|---|-----|---|
| | | 2 | 2 | 1 | 2-3 | 2-3 | 2 | 2-3 | 2 | 2-3 | 2-3 | 2 | 4 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Thiogene Golden Yellow AO | D | 2 | 2 | 1 | 2-3 | 2-3 | 2 | 2 | 2-3 | 2-3 | 2 | 4 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 1 |
| Thiogene Yellow GG | D | 2 | 2 | 1 | 2-3 | 2-3 | 2 | 2 | 2-3 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 2 | 1 | 2 | 1 | 2 | 1 |
| Thiogene Yellow G | D | 2 | 2 | 1 | 2 | 2-3 | 2 | 2 | 2-3 | 2 | 2 | 4-3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1-2 | 2-1 | 1 | 2-1 | 1 | 2-1 | 1 |
| Thiogene Orange OG | D | 2 | 2 | 1-2 | 2-3 | 2 | 2 | 2 | 2 | 2 | 2 | 4-3 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Thiogene Orange OG | K | 2 | 2 | 1-2 | 1-2 | 2 | 2 | 2 | 2 | 2 | 2 | 3-4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Orange RG | D | 2 | 2 | 1-2 | 2-3 | 2 | 2 | 2 | 2 | 2 | 1-2 | 4-3 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1-2 | 2-1 | 1 | 2-1 | 1 | 2-1 | 1 |
| Thiogene Orange RG | K | 2 | 2 | 1-2 | 1-2 | 2 | 2 | 2 | 2 | 2 | 2 | 3-4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Orange R | D | 2 | 2 | 1-2 | 2-3 | 2-1 | 2 | 2 | 2-3 | 2-1 | 2 | 4-3 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 | 1-2 | 1 |
| Thiogene Orange R | K | 2 | 2 | 1-2 | 1-2 | 2-1 | 2 | 2 | 2-1 | 2-1 | 2 | 4-3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Orange RR | D | 2 | 2 | 1-2 | 3 | 1-2 | 2 | 2 | 1-2 | 2 | 2 | 4 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 | 2 | 1 | 2 | 1 |
| Thiogene Orange RR | K | 2 | 2 | 1-2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4-3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Brown OG yellow shade | D | 2 | 2 | 1 | 2 | 2-1 | 2 | 2 | 2-1 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Brown GC | D | 2 | 2 | 1 | 2 | 2-1 | 2 | 2 | 2-1 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2-1 | 1 | 2-1 | 1 | 2-1 | 1 |

| Sulphur Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | Fastness to Water | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|---------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|-------------------|---------------------|-----|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|----------|
| | | | | | | Muriatic acid | Acetic acid | | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding |
| Thiogene Brown GC. . . | K | 2 | 1 | 1-2 | 2-1 | 1-2 | 1 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2-1 | 1 | 1 | 1 |
| Thiogene Khaki N conc. . | KCr | 1-2 | 1 | 1-2 | 2-3 | 2-3 | 1-2 | 4-3 | 1 | 2-1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 1 |
| Thiogene Bronze G. . . | D | 1-2 | 1 | 1-2 | 2 | 2 | 1 | 3-4 | 1 | 2-1 | 1-2 | 1 | 2-1 | 1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Brown GR. . . | D | 2 | 1-2 | 2 | 2-1 | 1-2 | 1 | 4 | 1 | 1 | 1-2 | 1 | 1 | 1 | 2-1 | 1 | 2-1 | 1 | 1 |
| Thiogene Olive Green G. . | D | 2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 2-1 | 1 | 1 | 1 | 1 |
| Thiogene Olive Green B. . | D | 2 | 1 | 1-2 | 1-2 | 1-2 | 1 | 4-5 | 1 | 1 | 1 | 1 | 1 | 1 | 2-1 | 1 | 1 | 1 | 1 |
| Thiogene Brown GRR. . . | D | 2-3 | 1-2 | 2 | 1-2 | 1-2 | 1 | 4 | 1 | 1 | 1-2 | 1 | 1 | 1 | 2-1 | 1 | 2-1 | 1 | 1 |
| Thiogene Brown R. . . | D | 2-3 | 1 | 2-1 | 2 | 1 | 1 | 4 | 1 | 1-2 | 1 | 1 | 1-2 | 2-1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Brown R. . . | K | 2 | 1 | 1-2 | 2-1 | 2 | 1-2 | 3-4 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Brown RR. . . | D | 2 | 1 | 2-1 | 2-3 | 2-3 | 2-1 | 4 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 2 | 2-3 | 1 | 2-3 | 1 | 1 |
| Thiogene Brown S. . . | D | 2 | 1 | 2 | 1-2 | 2 | 1 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Catechu R. . . | D | 2 | 1 | 1 | 2-3 | 3 | 2 | 4-5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 |
| Thiogene Dark Red G. . . | D | 2 | 2 | 2 | 2-3 | 2 | 1 | 5 | 1-2 | 1-2 | 2 | 2 | 2 | 2 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Dark Red R. . . | D | 2 | 2 | 2 | 2 | 2 | 1 | 5 | 1-2 | 1-2 | 2 | 2 | 2 | 2 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Rubine O. . . | D | 2 | 2 | 2-3 | 2-3 | 2-3 | 2-1 | 5 | 2 | 1-2 | 2 | 2 | 2 | 2 | 2-3 | 1-2 | 2 | 2 | 1-2 |

| Sulphur Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|---------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|---------------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|----------|
| | | | | | | Muriatic acid | Acetic acid | | Fastness to Water | Fastness to Washing | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding |
| Thiogene Rubine O . . . | K | 2 | 1-2 | 1 | 2-1 | 3-4 | 2-1 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Heliotrope . . . | D | 2 | 1-2 | 2-3 | 2 | 3 | 2 | 5 | 2 | 2-1 | 2-3 | 1-2 | 2-3 | 2 | 3-2 | 1-2 | 2 | 1-2 |
| Thiogene Violet B . . . | D | 2 | 1 | 3 | 1-2 | 3 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 1-2 |
| Thiogene Violet V . . . | D | 2 | 1 | 3-2 | 2 | 3 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 1-2 |
| Thiogene Cyanine G . . . | D | 1-2 | 1 | 1-2 | 2-1 | 3 | 1 | 3-4 | 1 | 1-2 | 1-2 | 2-1 | 1-2 | 1 | 1 | 1 | 1 | 1 |
| Thiogene Cyanine O . . . | D | 1-2 | 1 | 1-2 | 2-1 | 3 | 1 | 3-4 | 1 | 1-2 | 1-2 | 2-1 | 1-2 | 1 | 1 | 1 | 1 | 1 |
| Thiogene New Blue JL . . | D | 1-2 | 1 | 1 | 2 | 2-3 | 1 | 5 | 1 | 2 | 2 | 2 | 3-2 | 2 | 1 | 2 | 1 | 1 |
| Thiogene New Blue BL . . | D | 1-2 | 1 | 1 | 2 | 2-3 | 1 | 5 | 1 | 2 | 2 | 2 | 3-2 | 2 | 1 | 2 | 1 | 1 |
| Thiogene Blue B | D | 1-2 | 2-3 | 1-2 | 2-1 | 3 | 1 | 5 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Blue R | D | 1-2 | 1-2 | 1-2 | 2-1 | 3 | 1 | 5 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Blue RR | D | 1-2 | 1-2 | 2-1 | 2-1 | 3 | 1 | 5 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 |
| Thiogene Dark Blue BL . . | DD | 2 | 1-2 | 2-1 | 1-2 | 4 | 2 | 5 | 1-2 | 1-2 | 1 | 2-1 | 1-2 | 2 | 2-3 | 1-2 | 2 | 1-2 |
| Thiogene Dark Blue BTL . | DD | 2 | 1-2 | 2-1 | 2 | 4 | 3-2 | 5 | 1 | 1-2 | 1 | 2-1 | 1 | 2 | 2-1 | 1-2 | 2-1 | 1-2 |
| Melanogene Blue BG*) . . | | 2 | 1 | 2-3 | 2 | 2-3 | 1 | 4 | 1 | 1 | 1-2 | 1 | 1-2 | 1-2 | 2 | 1-2 | 1 | 1 |
| Melanogene Blue B*) . . | | 2 | 1 | 2-1 | 2 | 2-3 | 1 | 4 | 1 | 1 | 1-2 | 1 | 1-2 | 1-2 | 2 | 1-2 | 1 | 1 |

*) Fixing Salt.

| Sulphur Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids Mutaric acid Acetic acid | Fastness to Chlorine | Fastness to Water | Fastness to Washing | Fastness to Mulling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|----------------------------|------------------|---------------------|---------------------|-------------------|--------------------|--|----------------------|-------------------|---------------------|---------------------------|----------|--------------------------------------|----------|--------------------------------------|----------|---------------------|----------|
| | | | | | | | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding |
| Melanogene Blue B . . . | K | 2 | 1-2 | 1-2 | 1-2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1-2 | 1 |
| Thiogene Green B . . . | D | 2 | 1 | 2-3 | 2-3 | 4 | 2 | 1-2 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 | 3 | 1 | 3 | 1 |
| Thiogene Green G . . . | D | 2 | 1-2 | 2 | 2-3 | 3-4 | 1-2 | 1 | 1-2 | 2-1 | 1 | 2 | 1 | 2 | 1 | 2 | 1 |
| Thiogene Green GG . . . | D | 2 | 1 | 2-3 | 2-3 | 4 | 2 | 1-2 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 | 3-2 | 1 | 3-2 | 1 |
| Thiogene Green BL extra . | D | 2 | 1 | 2 | 2 | 4 | 1 | 1-2 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-3 | 1 | 2-3 | 1 |
| Thiogene Green GL extra . | D | 2 | 1 | 2 | 2 | 3-4 | 1 | 1-2 | 1-2 | 2-1 | 1-2 | 1-2 | 1-2 | 2-3 | 1 | 2-3 | 1 |
| Thiogene Black M liquid. . | D | 2-3 | 1 | 1-2 | 2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 |
| Thiogene Black BB liquid.. | D | 2-3 | 1 | 1-2 | 2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 |
| Thiogene Black BRR liquid. | D | 2-3 | 1 | 1-2 | 2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 |
| Thiogene Black MM conc.. | D | 2-3 | 1 | 1-2 | 2 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 |
| Thiogene Black 4B conc. . | D | 2-3 | 1 | 1-2 | 2 | 2-3 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 |
| Thiogene Black BRR conc. | D | 2-3 | 1 | 1-2 | 2-1 | 1-2 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 1-2 | 1-2 | 1-2 | 1 | 1 |
| Thiogene Diamond Black V | D | 2-3 | 1 | 1-2 | 2 | 2-3 | 1 | 1 | 1-2 | 1-2 | 1 | 2 | 1-2 | 1-2 | 1-2 | 1 | 1 |

| Indigo, Oxidation and Condensation Dyestuffs | Method of Dyeing | | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|--|------------------|-----|---------------------|-----|---------------------|---|-------------------|---|--------------------|-----|-------------------|-------------|----------------------|---|-------------------|---|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|--|
| | | | | | | | | | | | Muriatic acid | Acetic acid | | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | |
| Indigo MLB/RR | IK | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB/R | IK | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB | IK | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB/T | IK | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB/2B | IK | 3-4 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB/4B | IK | 3 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB/5B | IK | 3 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo MLB/6B | IK | 3 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo Red 3B | IK | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Indigo Red B | IK | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Indigo Scarlet S | IK | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo Scarlet S | K | 2 | 1 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo Fast Scarlet R | IK | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Indigo Orange R | IK | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 1 | |
| Indigo Brown G | IK | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Indigo Yellow 3G | IK | 2-1 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1-2 | 1 | 1 | 1-2 | 1 | 1 | 1 | |
| Aniline Black | | 1-2 | 2-1 | 1-2 | 1 | 1 | 1 | 1 | 2-3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | |
| Diphenyl Black | | 2 | 2-1 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1 | 1 | |
| Nitroso Blue MR | | 1 | 1-2 | 1-2 | 3 | 4 | 2-3 | 4 | 4 | 2-3 | 4 | 2-3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1-2 | 1-2 | |
| Nitroso Blue TO | | 1 | 1-2 | 1-2 | 3 | 4 | 1-2 | 4 | 4 | 1-2 | 4 | 2-3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1-2 | 1-2 | |
| Nitroso Brown | | 1 | 1-2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1-2 | 1-2 | |
| Nitroso Green | | 1 | 1-2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1-2 | 1-2 | |

| Insoluble Azo dyestuffs produced on the fibre | Method of Dyeing | Fastness to Rubbing | | Fastness to Ironing | | Fastness to Light | | Fastness to Alkali | | Fastness to Acids | | Fastness to Chlorine | | Fastness to Water | | Fastness to Washing | | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Change | | Acetic acid test | |
|---|------------------|---------------------|-----|---------------------|-----|-------------------|-----|--------------------|-----|-------------------|-------------|----------------------|----------|-------------------|----------|---------------------|----------|---------------------|----------|-----------------------------|--------|-----------------------------|--------|----------|--------|------------------|--------|
| | | 3 | 3 | 2 | 2 | 1-2 | 2 | 2 | 2 | Muriatic acid | Acetic acid | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change |
| Azo Orange NA | NG | 3 | 3 | 2 | 2 | 1-2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2-3 | 2-1 | 2 | 3-2 | 2-3 | 3-2 | 2-3 | 2 | 1-2 | 2 | 1-2 |
| Azophor Orange MN | NG | 3 | 3 | 2 | 2 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2-3 | 2-3 | 2-3 | 2-3 | 1 | 2-1 | 2 | 2 | 2 | 2 | 1-2 | 2 | 1-2 | 2-1 |
| Nitro Toluidine | NG | 3 | 3 | 2 | 2 | 2-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2-3 | 1 | 2 | 2 | 2 | 2 | 2 | 1-2 | 2 | 1-2 | 2-1 |
| Chloraniline | NG | 3 | 3 | 2 | 2 | 1-2 | 1 | 1 | 1 | 1 | 1 | 1-2 | 1-2 | 2 | 2 | 2-3 | 2-3 | 1 | 2 | 3 | 3 | 3 | 3 | 2-1 | 2 | 2-1 | 2 |
| Azophor Pink A | NG | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2-3 | 1 | 2 | 3 | 3 | 3 | 3 | 2-1 | 2 | 2-1 | 2 |
| Azo Pink BB | NG | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2-3 | 1 | 2 | 3 | 3 | 3 | 3 | 2-1 | 2 | 2-1 | 2 |
| Azo Pink NA | NG | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2-3 | 2 | 2 | 3-2 | 2-3 | 3-2 | 2-3 | 2 | 1-2 | 2 | 1-2 |
| Blue Red O | NG | 3-2 | 3-2 | 2 | 2 | 2 | 2-1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2-3 | 2-1 | 2 | 3 | 2-3 | 3 | 2-3 | 1-2 | 1 | 1-2 | 1 |
| Azophor Red PN | NG | 3 | 3 | 2 | 2 | 2-1 | 1-2 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1-2 | 2 | 2 | 2 | 2 | 1-2 | 2-1 | 2-1 | 2-1 |
| Parantraniline | NG | 3 | 3 | 2 | 2 | 2-1 | 1-2 | 1-2 | 1-2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1-2 | 2-1 | 2-1 | 2-1 |
| Amido Azo Benzole | NG | 3 | 3 | 2 | 2 | 2-3 | 1-2 | 1-2 | 1-2 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2-1 | 2 | 2-1 | 2 |
| Fast Azo Grenade M | NG | 3 | 3 | 2 | 2 | 2-3 | 1-2 | 1-2 | 1-2 | 3 | 1 | 1-2 | 1-2 | 2 | 2 | 2 | 2 | 1 | 2-3 | 2 | 2-3 | 2-3 | 2-3 | 2-1 | 2-3 | 2-1 | 2-3 |
| α-Naphthylamine | NG | 3 | 3 | 2-3 | 2-3 | 2-3 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2-3 | 2 | 2 | 2 | 1 | 2 | 2-3 | 2-3 | 3-2 | 2 | 1-2 | 2 | 2 | 2 |
| Benzidine | NG | 3 | 3 | 2-3 | 2-3 | 4 | 1 | 2-3 | 1 | 2-3 | 1 | 3 | 3 | 2-3 | 1 | 1 | 1 | 2 | 3-2 | 1 | 3-2 | 1 | 3-2 | 2-1 | 2 | 2 | 2 |
| Azophor Blue D | NG | 3 | 3 | 2 | 2 | 1-2 | 3-4 | 3-4 | 3-4 | 3-2 | 3-2 | 2 | 2 | 1-2 | 1-2 | 2 | 2 | 1-2 | 2 | 3-4 | 1-2 | 4 | 3 | 4 | 1-2 | 1-2 | 1-2 |
| Brown Salt R | NP | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3-2 | 3-2 | 3 | 3 | 3 | 3 | 3 | 3 | 1-2 | 3 | 2 | 3 | 2 | 3 | 1-2 | 3 | 3 | 3 |
| Brown Salt C | NP | 3 | 3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-1 | 2-1 | 3-2 | 3-2 | 3 | 3 | 3 | 3 | 1-2 | 3 | 2 | 3 | 2 | 3 | 1-2 | 3 | 3 | 3 |
| Dark Brown Salt R | NP | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2-1 | 2-1 | 3-2 | 3-2 | 3 | 3 | 3 | 3 | 1-2 | 3 | 2 | 3 | 2 | 3 | 1-2 | 3 | 3 | 3 |
| Dark Brown Salt G | NP | 3 | 3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-3 | 2-1 | 2-1 | 3-2 | 3-2 | 3 | 3 | 3 | 3 | 1-2 | 3 | 2 | 3 | 2 | 3 | 1-2 | 3 | 3 | 3 |

| Mordant Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | | Fastness to Chlorine | Fastness to Water | Fastness to Washing | | Fastness to Milling | | Fastness to Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|-------------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|-------------|----------------------|-------------------|---------------------|-----|---------------------|----------|------------------|----------|-----------------------------|----------|------------------|----------|
| | | | | | | Muriatic acid | Acetic acid | | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding |
| Alizarine Red SDG paste 20% | AlV | 3 | 2 | 1 | 1 | 2-3 | 1-2 | 2 | 1 | 2-1 | 1-2 | 2-3 | 2-3 | 3-4 | 1-2 | 4 | 3 | 2-3 | 2 |
| Alizarine Red SDG paste 20% | CrV | 2-3 | 2 | 1-2 | 2 | 4-3 | 2-1 | 2 | 1-2 | 2 | 2 | 3 | 3 | 2 | 2 | 4 | 3 | 3 | 3 |
| Alizarine Red 5F paste 20% | AlV | 3 | 2-1 | 1 | 2 | 1-2 | 1 | 2-1 | 1 | 1 | 1-2 | 2-3 | 1-2 | 3-4 | 1-2 | 3 | 3 | 1-2 | 2 |
| Alizarine Red 5F paste 20% | CrV | 2-3 | 2 | 1-2 | 2 | 4-3 | 2-1 | 2 | 1 | 2 | 2 | 3-2 | 1 | 1-2 | 1-2 | 4 | 3 | 3 | 3 |
| Alizarine Red 3RL paste 20% | AlV | 3 | 2 | 1 | 2 | 1-2 | 1 | 2-1 | 1 | 1 | 1 | 2-3 | 1 | 1-2 | 1 | 2-3 | 3 | 1 | 1-2 |
| Alizarine Red 3RL paste 20% | CrV | 2 | 2 | 1-2 | 2 | 4-3 | 2-1 | 2 | 1 | 2-1 | 2 | 2-3 | 1 | 1-2 | 1 | 4 | 3 | 3 | 3 |
| Alizarine Red 2AG paste 20% | AlV | 3 | 2 | 1 | 2-1 | 1-2 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 2 | 2-3 | 2-1 | 1-2 |
| Alizarine Red 2AG paste 20% | CrV | 2-3 | 2-1 | 1-2 | 2 | 4-3 | 1-2 | 2 | 1 | 2-1 | 2 | 2 | 1 | 1-2 | 1 | 4 | 3 | 3 | 3 |
| Alizarine Red 2A paste 20% | AlV | 3 | 2 | 1 | 2-1 | 1-2 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 2 | 2 | 2 | 1-2 |
| Alizarine Red 2A paste 20% | CrV | 2-3 | 2 | 1-2 | 2 | 4-3 | 2-1 | 2 | 1 | 2-1 | 2 | 2 | 1 | 1-2 | 1 | 4 | 3 | 3 | 3 |
| Alizarine Red Nr. 1 paste 20% | AlV | 3 | 2 | 1 | 2-1 | 1-2 | 1 | 1-2 | 1 | 1 | 1 | 1-2 | 1 | 1 | 1 | 2 | 2 | 2 | 1-2 |
| Alizarine Red Nr. 1 paste 20% | CrV | 2-3 | 1-2 | 1-2 | 2 | 4-3 | 2 | 2 | 1 | 1-2 | 2 | 2 | 2 | 2 | 1-2 | 4 | 3 | 3 | 3 |
| Alizarine Claret R paste | AlV | 3 | 2 | 1-2 | 1 | 3 | 1 | 4 | 1 | 2-1 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 2-3 | 2 |
| Alizarine Claret R paste | CrV | 3 | 2 | 1-2 | 2 | 4 | 1 | 4 | 1 | 2-1 | 2 | 2 | 1 | 1 | 1-2 | 5 | 3 | 3 | 3 |

| Mordant Dyestuffs | Method of Dyeing | Fastness to Rubbing | Fastness to Ironing | Fastness to Light | Fastness to Alkali | Fastness to Acids | Fastness to Chlorine | Fastness to Water | Fastness to Washing | Fastness to Milling | | Fastness to boiling in Soda | | Fastness to boiling in Acid | | Acetic acid test | |
|----------------------------|------------------|---------------------|---------------------|-------------------|--------------------|-------------------|----------------------|-------------------|---------------------|---------------------|----------|-----------------------------|----------|-----------------------------|----------|------------------|----------|
| | | | | | | | | | | Change | Bleeding | Change | Bleeding | Change | Bleeding | Change | Bleeding |
| Alizarine Yellow 5G powder | CrV | 2 | 2 | 1-2 | 1-2 | 5 | 1 | 1 | 1 | 1-2 | 1-2 | 2 | 1 | 4 | 1-2 | 3-2 | 2 |
| Alizarine Yellow GG paste | CrV | 2 | 1-2 | 2-1 | 2-3 | 4 | 2 | 2 | 2-3 | 2 | 1-2 | 2 | 1-2 | 4-3 | 1-2 | 2 | 1-2 |
| Alizarine Yellow R paste | CrV | 2 | 1-2 | 2-3 | 2-3 | 3 | 2-3 | 2 | 3-2 | 2 | 2-3 | 2-3 | 1 | 4-5 | 2-1 | 3-2 | 2 |
| Alizarine Orange paste | AlV | 3 | 1-2 | 2-1 | 2 | 1 | 1 | 1 | 1 | 1-2 | 1-2 | 1 | 1-2 | 2 | 1-2 | 1 | 1-2 |
| Alizarine Orange paste | CrV | 3 | 1-2 | 2-1 | 2 | 2 | 1 | 1 | 2 | 1-2 | 1-2 | 2 | 1-2 | 3 | 2-3 | 2-3 | 2-3 |
| Alizarine Brown paste | CrV | 3 | 2-1 | 2 | 2 | 3 | 2 | 1-2 | 1-2 | 1-2 | 2 | 2 | 2 | 3 | 3-2 | 3 | 3-2 |
| Ceruleine SW paste | CrV | 2 | 1 | 2 | 3-4 | 3-4 | 1 | 1 | 2 | 3-2 | 1-2 | 2-3 | 1-2 | 2 | 1-2 | 2 | 1-2 |
| Phlochromine B paste | CrV | 2 | 2 | 1-2 | 3 | 3 | 2-1 | 2 | 2-3 | 2 | 2 | 4 | 2 | 4 | 4 | 1 | 2 |
| Chromolaucine VM paste | CrV | 2 | 2 | 2 | 3 | 3 | 2 | 1-2 | 2-3 | 2 | 2 | 2 | 2 | 4 | 3-4 | 1 | 2 |
| Alizarine Blue DN paste | CrV | 3 | 2 | 2 | 3 | 3 | 2-1 | 2-3 | 2-3 | 2-3 | 1-2 | 3 | 1-2 | 2 | 2 | 2 | 1-2 |
| Alizarine Blue B paste | CrV | 3 | 1-2 | 2 | 3 | 3 | 2-1 | 2-3 | 1-2 | 2-3 | 1-2 | 3 | 1-2 | 2 | 2 | 2 | 1-2 |
| Alizarine Blue SR paste | CrV | 3 | 2 | 2 | 3 | 3 | 2-1 | 2-3 | 1-2 | 2-3 | 1-2 | 3 | 1-2 | 2-1 | 1-2 | 2-1 | 1-2 |
| Alizarine Blue SB powder | CrV | 3 | 2 | 2 | 3 | 3 | 2 | 2-3 | 1-2 | 2-3 | 1-2 | 3 | 1-2 | 2 | 1-2 | 2 | 1-2 |
| Alizarine Green S paste | CrV | 2 | 2 | 1-2 | 3-4 | 2 | 2-1 | 4-5 | 1-2 | 2-3 | 3 | 2-3 | 1-2 | 4 | 2 | 3 | 2 |

WOOL DYEING.

a) WOOL COLOURS CLASSIFIED ACCORDING TO METHODS OF DYEING.

- I. Dyeing in an Acid bath.
- II. Dyeing in an Alkaline bath.
- III. Dyeing in an Acetic acid bath.
- IV. Dyeing in a Neutral bath.
- V. Dyeing in an Acid bath and developing with Metal Salts.
- VI. Dyeing on a Mordant.
- VII. Vat dyeing.

I. DYEING IN AN ACID BATH.

Dyeing in an acid bath is the method most generally employed in wool dyeing. It is simple in its application, and almost all Acid, Azo and Dianil colours are dyed in this manner.

The bath is prepared with 10% Glauber's salt and 4% Sulphuric acid or 10% Tartar Substitute, and the necessary amounts of dyestuff; after entering the material, the temperature is raised to the boil and the dyeing operation finished by boiling for $\frac{3}{4}$ —1½ hours. For dyestuffs which do not equalise well, more Glauber's salt and less or weaker acids are required. In this case one of the following methods is employed:

a) The bath is prepared with 20—100% Glauber's salt and 4% Sulphuric acid or the corresponding amount of Tartar Substitute; the goods are entered at 140—160° F., the temperature raised to the boil, and the bath kept at the boil for $\frac{3}{4}$ —1 hour. For further lots the old baths are replenished with 20—10% Glauber's salt, the amount of acid remaining the same as in the first bath, or Tartar Substitute may be used instead.

b) The bath is prepared with the necessary amount of dyestuff, 10—20% Glauber's salt and 2—3% Sulphuric acid; the goods are entered at a medium temperature, the bath gradually heated to the boil, and boiling continued for 1 hour.

c) The bath is prepared with the required amount of dyestuff, 20% Glauber's salt and 3% Acetic or 1% Sulphuric acid. The material is entered at a medium temperature, the bath gradually heated to the boil, and boiled for $\frac{1}{2}$ an hour; then 1—2% Sulphuric acid are added and boiling continued for $\frac{1}{2}$ —1 hour

d) The bath is prepared with the dyestuff, 10—20% Glauber's salt and 5—10% Ammonium Acetate; the goods are entered at a low temperature, the temperature then raised to the boil within $\frac{1}{2}$ — $\frac{3}{4}$ of an hour, and the dyeing operation finished by boiling for 1 hour; if the bath is not exhausted, twice 2% Acetic acid, or 2% Acetic acid first and then 1—2% Sulphuric acid are added at intervals of 15 minutes.

The following dyestuffs are dyed in an acid bath:

| | |
|-----------------------------------|---------------------------------|
| Chinoline Yellow O, extra, conc., | Fast Claret Red O, |
| Naphthol Yellow S, SE, SL, | Naphto Rubine O, |
| Flavazine 3GL, L, S, T, | Cloth Red O, |
| Milling Yellow O, | Dianil Red R, 4B, 6B, 10B, |
| Dianil Pure Yellow HS, | Delta Purpurine 5B, |
| Dianil Yellow 3G, R, RR, | Brilliant Dianil Red R, |
| Cresotine Yellow G, | Dianil Fast Red PH, |
| Oxydianil Yellow G, O, | Dianil Crimson B, G, |
| Aurophenine O, conc., | Dianil Claret Red G, B, |
| Fast Yellow O, S, | Dianil Violet H, |
| Azo Yellow O, conc., | Dianil Brown 3GO, G, 2G, MH, |
| Azoflavine H, O, | BD, R, 3R, B, D, |
| Chrysoine G, R, | Dianil Fast Brown B, |
| Victoria Yellow O, double, conc., | Fast Brown O, yellow shade, L, |
| conc. D, | Azo Brown V, |
| Metanil Yellow extra, | Azo Acid Brown RO, R conc., |
| Dianil Orange N, G, | Azo Acid Red B, 5B, |
| Orange Nr. 4, G, Nr. 2, 2L, | Amido Naphthol Red G, BB, 6B, |
| Nr. 1, R, RR, | Azo Acid Carmine B, |
| Brilliant Orange G, O, R, | Azo Acid Magenta G, B, |
| Brilliant Croceine yellow shade, | Archil Substitute G, |
| blue shade, R, B, BB, 3B, | Chromotrope RR, BB, 6B, 8B, |
| 5B, 8B, | 10B, |
| New Coccine O, | Victoria Violet 4BS, 8BS, 4BSL, |
| Nassovia Scarlet O, | RL, |
| Milling Scarlet 4RO, 4R conc., | Azo Acid Blue B, 3BO, 3B conc., |
| Victoria Scarlet 3G, 2G, G, R, | Naphtalene Blue B, B extra, BN |
| RR, 3R, 4R, 5R, 6R, | conc., BH, D, DN, DN |
| Scarlet G, R, RR, 3R, 4R, 5R, | extra, V, R, LR, J, DL, |
| 6R, B extra, | Naphtalene Dark Blue G conc., |
| Scarlet Crystals 6R, | EG extra, |
| Fast Red O, S, | Patent Marine Blue LE, V, B, |
| Roccelline N, | Amido Blue B, GR, LE, GS, |
| Brilliant Crimson O, B, | Azo Acid Black, R, B, G, 3BL, |
| Amido Brilliant Red G, | BL, GL, TL conc., 3BN, |
| Azo Brilliant Carmine B, | TN, 3BLOO, 4BL extra, 3BL |
| Victoria Rubine O, | extra, TL extra, KL extra, |
| Naphthol Red O, | KRL extra, |
| Amaranth O, | Alphyl Blue Black O, OK, |
| Claret Red G, B, R, G extra, | Amido Black 10B, 10BO, 3B, |
| B extra, R extra, O, | T, E, ET, A, AT, |

| | |
|--|---|
| Carbon Black B, B conc., BD, T, 3B, E, | Victoria Blue B, R, 4R, Pure Blue O, conc., double conc., double conc. R, |
| Tolyl Black BB, B, BG, | Opal Blue sup. sol., |
| Amido Naphtho Black S, 6B, 6B conc., 4B, 4B extra, 4B conc., 4BH, BX, B conc., RK, N conc., | China Blue R, Nr. 1, Nr. 2, Emperor Blue O, Navy Blue O, Full Blue O, Cloth Blue O, Purple Blue O, Laundry Blue O, Opal Blue red shade, blue shade, green shade, Blue red shade, blue shade, TB, TBA, TR, |
| Fast Dark Blue B extra, B extra conc., R, | Bleu de Lyon O, R, RR, Guernsey Blue O, Soluble Blue RRR, RR, R, SV, TBA, TBB, |
| Black Blue O, | Conc. Cotton Blue RR, R, Nr. 1, Nr. 2, Nr. 2 double, |
| Fast Blue O sol. in water, R, RR, 3R extra, D, G extra, 5B, green shade, extra green shade, | Cotton Blue extra OO, Cotton Light Blue O sol. in water, |
| Nigrosine Nr. I, Nr. IV, | Methyl Blue for cotton MLB, |
| Acid Alizarine Grey G, | Patent Blue A, AF, AJ1, AN, K, superior, extra, N, L, LE, V, C, B, J1, J2, J3, EN, VN, Y, RB, RBN, |
| Acid Rosamine A, | Patent Pure Blue O, Cyanine B, |
| Fast Acid Red A, | Alizarine Direct Blue E3B, EB, ER extra, |
| Fast Acid Violet B, R, A2R, RO, A2RO, RL, RBE, RGE, BE, | Alizarine Direct Violet R, Indigo Substitute, B, B extra, BS, BS extra, A extra, V extra, SS, WE, K, |
| Fast Acid Eosine G, G extra, | Acid Green GI, O, conc., conc. D, M, conc. M. |
| Fast Acid Phloxine A, A extra, | Acid Green solution fivefold conc., Naphthalene Green V conc., Fast Acid Green BB, BB extra, BB extra conc., Patent Green O, V, VS, VVS. |
| Fast Acid Magenta G, G conc., Fast Acid Blue R, R conc., Sulpho Rosazeine B extra, B, G extra, G, | |
| Milling Blue 2R extra, | |
| Alizarine Direct Blue B, | |
| Alizarine Direct Green G, | |
| Red YB, Y, Y2G, | |
| Rosazeine B, B extra, G, G extra, O, extra, | |
| Acid Magenta O, B, D, G, GG, 3G, extra, extra B, M, N, | |
| Acid Cerise O, II, | |
| Acid Maroon O, | |
| Maroon S, | |
| Orseilline R, B, | |
| Acid Violet 3RA, 4RS, 3RS, II, R conc. new, N, 5BF, 6BL, 6BN, | |
| Neutral Violet O, | |
| Neutral Blue R, 3R, | |

The following Acid dyestuffs equalise readily and may therefore be added to the boiling bath for shading purposes:

| | |
|-----------------------------------|--|
| Chinoline Yellow O, extra, | Orange G, Nr. 1, Nr. 2, Nr. 4, Nr. 4LL, |
| Naphtol Yellow S, SE, | Brilliant Orange G, O, |
| Flavazine S, L, | Azo Acid Brown RO, R conc., |
| Fast Yellow O, S, | Azo Acid Red B, 5B, |
| Azo Yellow O, conc., | Archil Substitute G, |
| Victoria Yellow O, double, conc., | |

| | |
|---------------------------------|--------------------------------|
| Chromotrope G, 2R, | Rosazeine O, B, OG, B extra, |
| Azo Acid Magenta G, B, | G extra, |
| Amido Naphthol Red G, 2B, | Indigo Substitute, |
| 6B, | Patent Blue V, N, superior, L, |
| Fast Acid Red A. | G, B, J1, J2, J3, G conc., |
| Fast Acid Violet A2R, R, RL, | B conc., |
| RGE, RBE. | Patent Pure Blue O, |
| Fast Acid Eosine G, G extra, | Cyanine B, B conc., |
| Fast Acid Phloxine A, A extra, | Fast Acid Green all brands, |
| Fast Acid Magenta G, G extra, | Naphtalene Green V, conc., |
| Sulpho Rosazeine B, B extra, G, | Patent Green V, VS, |
| G extra. | Victoria Blue B. |

II. DYEING IN AN ALKALINE BATH.

The process of dyeing is carried out as follows:

The dyebath is prepared with 5-10% Borax and the dyestuff solution; the goods are entered, the liquid heated to the boil and boiled for $\frac{3}{4}$ -1 hour. Then the material is well rinsed and immediately taken into a fresh bath which contains 5% Sulphuric acid; the goods are worked in this bath for $\frac{1}{4}$ of an hour at 110-160° F. Instead of Sulphuric acid, the souring bath may contain Alum or Double Chloride of Tin, which increases the fastness to milling.

The following colours are suitable for dyeing in an alkaline bath:

Alkaline Blue, all brands,
Methyl Alkaline Blue MLB,
Alkaline Violet O.

III. DYEING IN AN ACETIC ACID BATH.

The method suitable for Resorcine colours is the following:

The dyebath is prepared with 10% Acetic acid 12° Tw., 10% Acetate of Soda, and the necessary dyestuff solution; the goods are entered cold, the liquid heated up to 175° F. in $\frac{1}{2}$ an hour, and the dyeing operation carried out for 1 hour at this temperature. The Acetate of Soda being a weak alkali, impedes the coupling of fibre with the colour acid, and therefore enhances the equalising. By keeping the temperature of the dyebath below boiling point, the results are likewise beneficially affected.

Another process of dyeing is the following: The goods are boiled with

5% Alum
5% Tartar and
5% Acetic acid 12° Tw.,

for $\frac{1}{2}$ an hour; then the bath is cooled to 120° F., the dyestuff solution added, the dyebath again heated to the boil and boiled for

$\frac{1}{4}$ — $\frac{1}{2}$ hour. It is advisable to heat up slowly, and enter the goods at a medium temperature, in order to avoid uneven results. Strong mineral acids, which are deleterious to the combination of colour acid with the wool and moreover liable to dull the shades, must be avoided.

The following colours can be dyed by these methods:

Eosine, all brands,
Erythrosine, all brands,
Phloxine, all brands,
Rose Bengale, all brands.

IV. DYEING IN A NEUTRAL BATH.

This method is employed in wool dyeing for Basic colours. These dyestuffs are generally dyed without any further addition, in a bath which is corrected with Acetic acid. At first, a little Acetic acid is added to the dyebath, then the carefully prepared dyestuff solution added, and the goods dyed at 175 — 195° C.

A small surplus of Acetic acid is not injurious, but on the contrary, prevents colour stains which, when once present, are only removed with great difficulty from the goods. Greater quantities of Acetic acid, however, tend to retain the dyestuff in the bath.

A few Basic colours, especially Victoria Blue and Rosazeine (with the exception of 4G and 6G) are dyed, instead of in a neutral bath, in an acid bath, like ordinary Acid colours; they may therefore be combined with the latter and in this way they yield very even shades, and the danger of colour stains is also greatly reduced.

The following colours are suitable for dyeing in a neutral bath:

| | |
|-----------------------------------|-----------------------------------|
| Auramine conc. O, I, II, | Methylene Violet RRA, BN, |
| Methylene Yellow H, | 3RA extra, |
| Flavophosphine 4G conc. new, | Rosolane O, T, |
| 4GO new, GG conc. new, | Magenta extra large cryst., extra |
| GGO new, G conc. new, | yellow large cryst., extra |
| GO new, R conc. new, | yellow small cryst. |
| RO new, | New Magenta O, |
| Phosphine extra O, | Methyl Violet 5R superior, 3R |
| Vesuvine 4BG conc., 2R, O, | superior, R superior, BB |
| conc, extra yellow, | superior, BB, 4B, |
| Rosazeine B, B extra, G, G extra, | Violet Crystals O, |
| O, extra, | Malachite Green crystals extra, |
| Safranine O, conc., AN extra, | crystals extra N, |
| conc. B, GGS, | Brilliant Green crystals extra, |
| Methylene Heliotrope O, | crystals extra N. |

Another method, which is often employed with the stoving process, especially for the production of delicate, brilliant tints, known as "Sulphur" shades, is the following:

The dyebath is prepared with 5% Olive Oil soap and the necessary dyestuff solution; the goods are entered, and dyed at 120—140° F. until sufficient dyestuff is exhausted. After dyeing, the material is hydroextracted without being rinsed, and stoved in the Sulphur stove.

The following colours are suitable for this method of dyeing:

| | |
|-----------------------------------|--------------------------------------|
| Auramine conc., O, I, II, | Magenta extra large cryst., extra |
| Methylene Yellow H, | yellow small cryst., extra |
| Rosazcine B, B extra, G, G extra, | yellow large cryst., |
| O, extra, | New Magenta O, |
| Safranine O, conc., AN extra, | Methyl Violet all brands, |
| conc. B, GGS, | Violet Crystals O, |
| Methylene Heliotrope O, | Victoria Blue B, R, 4R, |
| Methylene Violet RRA, BN, 3RA | Malachite Green crystals extra, |
| extra, | cryst. extra N, |
| Rosolane O, | Brilliant Green cryst. extra, cryst. |
| | extra N. |

Finally, a special process must be mentioned, which is suitable for Brilliant Green and Malachite Green, and which consists of mordanting the goods first with Sulphur in order to produce brighter and faster shades than it is possible to produce by the ordinary methods.

The goods are treated in a wooden cistern with 15% Hypo-sulphite of Soda, 3% Sulphuric acid and 5% Alum for 1 hour at 140° F., and then immersed in this bath for several hours. After rinsing until all acid is removed, they are dyed in a fresh bath with Brilliant Green or Malachite Green at 175—195° F.

V. DYEING IN AN ACID BATH AND DEVELOPING WITH METAL SALTS.

This process was introduced by the Farbwerke Hoechst; the principle of this method consists in the fact that the acid colouring matter is first taken up and firmly united with the wool fibre in an acid bath, and then converted by a subsequent treatment with Bichrome, Alum, Fluoride of Chrome and Copper Sulphate into new fast combinations on the fibre.

The following paragraphs contain a summary of the effect which the four principal methods of aftertreatment produce on certain colours:

1. Developing with Bichrome.

The method of developing with Bichromate of Potash or Bichromate of Soda is by far the most important. It is applicable to the greatest number of dyestuffs, and yields the fastest colours even in cases where other modes of developing are well adapted.

The following method is the usual one for developing with Bichrome:

The dyebath is prepared with 10—20% Glauber's salt and 3—5% Sulphuric acid (dyestuffs which equalise with difficulty require more Glauber's salt and weaker acids). The goods are entered at 122° F. the temperature raised to the boil, boiling continued for 1 hour and if necessary some more acid gradually added. When the bath is sufficiently exhausted it is slightly cooled, then 1—3% Bichrome added, according to depth of shade required, the temperature again raised to the boil and the shade developed by boiling for another $\frac{1}{2}$ —1 hour.

Chromotrope FB, F4B, DWS, SR, Chromotrope Blue A, WB and WG, Chrome Brown RO, BO, are developed with Bichromate of Potash, 1—2% Sulphuric acid and 1—3% Lactic acid in order to obtain greater fastness to milling.

Dyestuffs suitable for developing with Bichrome:

| | |
|--|---|
| Alizarine Yellow 5G, GGW powder, GGW paste, RW powder, RW paste, | Alizarine Direct Violet R (turns greenish blue), |
| Mordant Yellow O. conc., N, | Acid Alizarine Green G, |
| Acid Alizarine Yellow RC, | Ceruleine BR paste, B paste, BWR powder, |
| Dianil Fast Red PH, | Acid Alizarine Blue BB, GR (turn grey), WE, WEB conc., |
| Alizarine Red 1WS, 3WS, | Acid Alizarine Grey G, |
| Acid Alizarine Red G, B, | Acid Alizarine Blue Black B, 3B, RB, RBN, A. |
| Acid Alizarine Grenade R, | Acid Alizarine Black 3B extra, 3B, R, R extra, RG, RH, AC, T, TG, |
| Acid Alizarine Violet N, | Acid Alizarine Black SE paste, SE powder. SET paste, SET powder, SN, SNT, SNR, SNG, |
| Acid Alizarine Brown R, B, BB, T, RH extra, RP, | Chrome Black 2G, B, T (to be developed with bichrome and sulphate of copper). |
| Chromogene I, | |
| Chrome Brown RO, BO, | |
| Chromotrope FB, F4B, DW, 8B, 10B, S, SB, SR, | |
| Chromotrope Blue A, WB, WG, | |
| Fast Mordant Blue R, B, BT, RT, BBR, | |
| Alizarine Direct Blue B, | |
| Alizarine Direct Green G. | |

The following are the most important shading dyestuffs which may be added to the Chrome bath. They equalise well and are fast to milling.

| | |
|-----------------------------|-------------------------|
| Flavazine T, | Acid Violet 5BF, |
| Fast Acid Magenta GG conc., | Patent Blue A, AF, AJ1, |
| Fast Acid Violet B, R, ARR, | Milling Blue 2R extra |
| RGE, BE, RL, | |

For loose wool the following dyes, which are also fast to milling, but do not equalise so well, may be used.

| | |
|---------------------------|----------------------------|
| Milling Yellow O, | Scarlet B extra, |
| Milling Scarlet 4R conc., | Alizarine Direct Blue B, |
| Oxydianil Yellow, | Alizarine Direct Green G, |
| Dianil Yellow, | Amido Dark Bottle Green B. |
| Cresotine Yellow, | |

If the shading dyes have not to be fast to milling, the following, which are also fast, may be used.

| | |
|-----------------------------------|---------------------------------|
| Chinoline Yellow O, extra, conc., | Rosazeine O, extra, B, B extra, |
| Flavazine L, S, | G, G extra, |
| Fast Yellow O, S, | Black Blue O, |
| Azo Yellow O, conc., | Acid Violet N, 3RA, 6BL, 6BN, |
| Victoria Yellow O, double, conc., | Patent Blue V, N, L, LE, C, |
| concent. D, | B, J1, J2, J3, EN, VN, Y, |
| Orange Nr. 2, Nr. 4. G, | RB, RBN, |
| Brilliant Orange G, O, R, | Cyanine B, |
| Azo Acid Red B, 5B, | Alizarine Direct Blue E3B, EB, |
| Amido Naphthol Red G, BB, | Naphtalene Green V, conc., |
| 6B, | Fast Acid Green BB, BB extra, |
| Fast Acid Red G, G extra, | Patent Green V, VS. |
| Fast Acid Phloxine A, A extra, | |

The Chromate process:

Instead of dyeing at the commencement in an acid bath and then developing by adding bichrome, the bichrome may be added at the start, as previously recommended by us in the case of Chromotrope. The following additions are made: 10% Glauber's salt, 5% acetic acid, and $\frac{1}{4}\%$ to $1\frac{1}{2}\%$ bichrome, bringing the bath up to the boil in $\frac{1}{2}$ hr. Boil for $\frac{1}{2}$ hr. add 2% formic acid, and boil until the bath is exhausted. The following products are dyed in this manner: Autochrome Red G, Autochrome Yellow R, Autochrome Brown G, Autochrome Grey G; also Mordant Yellow O and Alizarine Yellow GGW. For shading Patent Blue A, Neutral Blue R, 3R, Milling Blue 2R extra, Milling Scarlet 4R, 4RO, 4R conc., Fast Acid Violet R, A2R, and Acid Violet 5BF, may be used.

2. Developing with Fluoride of Chrome.

Shades developed with Fluoride of Chrome are almost always inferior as regards fastness to washing and milling to those developed with Bichrome; for that reason Fluoride of Chrome is employed much more rarely for developing, than Bichrome. Exceptions are Acid Alizarine Blue BB, GR and the Acid Alizarine Dark Blue brands, which are almost exclusively developed with Fluoride of Chrome, and by this means yield more valuable colours than when developed with Bichrome.

The following is the usual method for developing with Fluoride of Chrome:

The dyebath is prepared with 10—20% Glauber's salt and 3—5% Sulphuric acid, (or, according to the equalising property of the dyestuff with other weaker acids) together with the necessary dye. The goods are entered at 122° F. the temperature raised to the boil, and boiling continued for 1 hour. For dyestuffs which do not equalise easily, the acid required is added later. When the bath is nearly exhausted, it is slightly cooled, 1—4% Fluoride of Chrome added, according to depth of shade, the temperature again raised to the boil and the shade developed by boiling for a further hour.

Dyestuffs suitable for developing with Fluoride of Chrome :

| | |
|--|---|
| Alizarine Yellow 5G, GGW powder, GGW paste, RW powder, RW paste, | Acid Alizarine Green G, Ceruleine B paste, BW paste, BWR, |
| Mordant Yellow O, | Fast Mordant Blue R, B, RT, BT, BBR. |
| Acid Alizarine Yellow RC, | Acid Alizarine Grey G, |
| Alizarine Orange N, R, P, | Acid Alizarine Blue Black 3B, |
| Dianil Fast Red PH. | Chromotrope 2R, 2B, 6B, 8B, 10B, |
| Alizarine Red 1WS, 3WS, PS, | Acid Alizarine Black 3B extra, |
| Acid Alizarine Red B, G, | 3B, R, R extra, RG, RH, |
| Acid Alizarine Grenade R, | AC, T, TG, SE paste, SE powder, SET paste, SET powder, SN, SNT. |
| Acid Alizarine Violet N, | |
| Acid Alizarine Brown B, BB, R, | |
| T, RH extra, RP, | |
| Acid Alizarine Blue GR, BB, WE, | |
| Acid Alizarine Dark Blue SN, | |

Shading dyestuffs which may be added to the Developing bath :

| | |
|-----------------------------------|------------------------------------|
| Chinoline Yellow O, extra, conc., | Fast Acid Magenta G, G conc., |
| Flavazine L, S, T, | Rosazeine O, extra, B, B extra, |
| Fast Yellow O, S, | G, G extra, |
| Azo Yellow O, conc., | Milling Blue 2R extra, |
| Victoria Yellow O, double, conc., | Blue Black O, |
| Chrysoine G, R, | Amido Dark Bottle Green B, |
| Orange G, Nr. 2, Nr. 4, | Acid Violet 6BN, 5BF, N, 6BL, 3RA, |
| Brilliant Orange G, O, R, | Patent Blue A, AJ1, AF, V, N, |
| Azo Acid Red B, 5B, | L, LE, C, B, J1, J2, J3, |
| Amido Naphthol Red G, BB, 6B, | EN, VN, Y, RB, RBN, |
| Azo Acid Carmine B, | Cyanine B, |
| Fast Acid Red A, | Alizarine Direct Blue E3B, EB, |
| Fast Acid Violet B, R, A2R, | Naphtalene Green V, conc., |
| RL, RGE, RBE, | Fast Acid Green BB, BB extra, |
| Fast Acid Eosine G, G extra, | Patent Green V, VS. |
| Fast Acid Phloxine A, A extra, | |

3. Developing with Alum.

Developing with Alum is principally resorted to in the production of Madder shades which are fast to light and milling, Alizarine Reds; these colours are shaded with Alizarine Orange and Alizarine Yellow. Sometimes Chromotropes are developed with Alum, in order to produce shades fast to water. The method of dyeing is as follows:

The dyebath is prepared with 3—4% Sulphuric acid, 10% Glauber's salt and the required amount of dyestuff. The goods are entered at 122° F., the bath heated to the boil, and boiling continued for 1 hour; then 5—10% Alum (free from iron) are added, according to the depth of shade required, and the shade developed by boiling for another hour.

Dyestuffs suitable for developing with Alum :

| | |
|------------------------------|-----------------------------|
| Alizarine Yellow GGW powder, | Alizarine Red 1WS, 3WS, PS, |
| GGW paste, 5G, | Chromotrope RR, BB, 6B, 8B, |
| Alizarine Orange N, R, P, | 10B. |

Shading dyestuffs which may be added to the Developing bath:

| | |
|-----------------------------------|---------------------------------|
| Chinoline Yellow O, extra, conc., | Fast Acid Magenta G, G conc., |
| Flavazine S, L, T, | Rosazaine O, extra, B. B extra, |
| Azo Yellow O, conc., | G, G extra, |
| Victoria Yellow O, double, conc., | Milling Blue 2R extra, |
| Orange G, Nr. 2, Nr. 4, | Blue Black O, |
| Brilliant Orange G, O, R, | Amido Dark Bottle Green B, |
| Scarlet R, 2R, 3R, B extra, | Acid Violet 6BN, 5BF, N, 6BL, |
| Azo Acid Red B, 5B, | 3RA, |
| Amido Naphthol Red G, BB, | Patent Blue A, AJ1, AF, V, |
| 6B, | N, L, LE, C, B, J1, J2, J3, |
| Azo Acid Carmine B, | EN, VN, Y, RB, RBN, |
| Fast Acid Red A, | Cyanine B, |
| Fast Acid Violet B, R, A2R, | Alizarine Direct Blue E3B, EB, |
| BE, RGE, RBE, RL, | Naphtalene Green V, conc., |
| Fast Acid Eosine G, G extra, | Fast Acid Green BB, BB extra, |
| Fast Acid Phloxine A, A extra, | Patent Green V, VS. |

4. Developing with Copper Sulphate.

Several Developing dyestuffs form pronounced copper lakes with Copper Sulphate, and these are superior to the ordinary acid dyed shades as regards fastness to Alkali, Water, Washing and above all, to Light. These copper lakes do not withstand strong alkaline treatments such as heavy milling. They are therefore generally used in piece dyeing.

The dye bath is prepared with 30% Glauber's salt and 2-4% Sulphuric acid or with 20% Glauber's salt and 10% Tartar Substitute, together with the necessary amount of dyestuff; the goods are entered at 86-104° F., the temperature slowly raised to the boil and boiling continued for 1 hour; then 1-3% Copper Sulphate are added and the shade developed by boiling for another ½ hour. In many cases the Copper Sulphate may be added initially to the dye bath.

Dyestuffs suitable for developing with Copper Sulphate.

| | |
|-------------------------|------------------------------|
| Copper Red N, | Chrome Black 2G, B, T (to be |
| Copper Blue B, B extra, | developed with chrome and |
| Copper Black S, SB, | copper). |

Shading dyestuffs which may be added to the Developing bath:

| | |
|-----------------------------------|--------------------------------|
| Chinoline Yellow O, extra, conc., | Fast Acid Phloxine A, A extra, |
| Flavazine S, L, T, | Fast Acid Magenta G, G conc., |
| Azo Yellow O, conc., | Milling Blue 2R extra, |
| Victoria Yellow O, conc., double, | Acid Violet 6BN, 5BF, N, 6BL, |
| Orange G, Nr. 2, Nr. 4, | 3RA, |
| Brilliant Orange G, O, R, | Patent Blue A, AJ1, AF, V, |
| Azo Acid Red B, 5B, | N, L, LE, C, B, J1, J2, J3, |
| Amido Naphthol Red G, BB, | EN, VN, Y, RB, RBN, |
| 6B, | Cyanine B, |
| Fast Acid Red A, | Alizarine Direct Blue E3B, EB, |
| Fast Acid Violet B, R, A2R, | Naphtalene Green V, conc., |
| BE, RGE, RBE, RL, | Fast Acid Green BB, BB extra, |
| Fast Acid Eosine G, G extra, | Patent Green V, VS. |

VI. DYEING UPON PREVIOUSLY MORDANTED MATERIAL.

Contrary to the products which have been discussed hitherto, the Mordant colours require a mordant for forming coloured compounds on the fibre. For this purpose it is necessary to precipitate before dyeing, within the wool fibre, a basic Metal salt in as fine a state as possible, and as insoluble a form as possible, and one which is capable of uniting with the dyestuff, which reacts as a weak acid, to form a coloured salt-like compound, the colour lake, thereby imparting to the fibre a tinctorial effect.

Dyeing with Mordant dyestuffs, therefore, consists of two operations, mordanting and dyeing. For mordanting, Alumina and Chrome Oxide are to be considered.

Whilst the Alum mordant is almost entirely used for red shades, and its use is therefore restricted, the Chrome mordant is very largely employed for all Mordant colours.

1. Alum Mordant.

a) The Mordant bath is prepared with 10% Alum, 3% Tartar and 2% Oxalic acid for dark shades, and with 5% Alum, 1½% Tartar and 1% Oxalic acid for light shades; the goods are entered, boiled for 1½ hours and then well rinsed.

b) The dye bath is prepared with 2% Tannin and 2½% Acetate of Lime, the dye-stuff is previously mixed with pure water and then added to the bath. The goods are entered at the usual temperature and well worked whilst the bath is heated to the boil in 1 hour; boiling is continued for 1½ hours, then the material well rinsed and dried. Alizarine Red 1WS, Alizarine Red PS, Ceruleine and Alizarine Yellow GGW are dyed with the addition of Acetic acid.

The following dyestuffs are suitable for dyeing upon Alum-mordanted material:

| | |
|----------------------------------|--------------------------------|
| Alizarine Yellow 5G, GGW | Alizarine Brown paste, powder, |
| paste, GGW powder, | R paste, R powder, S powder, |
| Mordant Yellow O, | RD powder, N paste, F paste, |
| Alizarine Orange paste, powder, | H paste, WR paste, |
| N paste, R paste, P paste, | Ceruleine paste A, paste SW |
| Alizarine Red, all paste brands, | conc., S, S conc., |
| 1WS, 3WS, PS, | Anthrol Blue NR, NG. |
| Alizarine Claret R paste, | |

The following dyestuffs, which equalise well and are fast to milling, may be used for shading upon alum-mordanted material without cooling the bath:

| | |
|-------------------------------|-------------------------|
| Flavazine T, | Acid Violet 5BF, |
| Fast Acid Violet B, R, A2R, | Milling Blue 2R extra, |
| BE, RGE, RBE, | Patent Blue A, AJ1, AF. |
| Fast Acid Magenta G, G conc., | |

The following also equalise well but are not fast to milling:

| | |
|----------------------------------|-------------------------------|
| Flavazine S, L, | Rosazeine O, B, G, extra, B |
| Azo Yellow O, conc., | extra, G extra. |
| Victoria Yellow O, conc, double, | Fast Acid Eosine G, G extra, |
| Orange G, Nr. 2. Nr. 4, | Acid Phloxine A, A extra. |
| Brilliant Orange G, O, R, | Acid Violet N, 6BN, 6BL, 3RA, |
| AmidoNaphthol Red, G, EB, 6B, | Naphtalene Green V, conc. |

2. Chrome Mordant.

A. Two-bath Method.

For mordanting wool with Chrome, Bichromate of Potash is used, which, under the reducing action of the wool substance, is fixed on the wool fibre by boiling. The Chrome Oxide, however, is more completely fixed on wool if, at the same time, reducing substances are present in the bath. Instead of Bichromate of Potash, Bichromate of Soda may be used.

The method usually adopted for mordanting wool is as follows:

a) The mordanting bath is prepared with:

| | | | | |
|-------------|----|-------------------|----|--------------------|
| 3% Bichrome | or | 3% Bichrome | or | 2% Bichrome |
| 2½% Tartar | | 1% Sulphuric acid | | 3% Lactic acid |
| | | | | 1% Sulphuric acid. |

Hard water is previously corrected with about 5% Acetic acid of 12° Tw. The goods are entered at 158° F., the bath heated to the boil — very slowly when using lactic acid — and boiling continued for 1½ hours. The material is generally rinsed before dyeing.

b) Dyebath: The dyebath is again corrected, according to the degree of hardness of the water and the nature of the colour used, with 2–10% Acetic acid 12° Tw.; the material is entered cold, the temperature raised within 1 hour to the boil and the goods boiled for 1½–2 hours. Pieces, hats etc. which do not dye through easily, are boiled first with 5% Acetate of Ammonia for ½–¾ of an hour and then the Acetic acid is added.

When using mechanical appliances, the dyebath is prepared with the necessary dyestuffs, which, after diluting with water, are added to the bath through a fine sieve; then 2–3% Ammonia are added, the circulation started, and raised to the boil. After boiling for 1 hour, some Acetic acid is gradually added until all the dyestuff is exhausted, boiling being continued all the time.

B. One-bath Method.

The dyebath is prepared with 1½% Bichrome, 3% Lactic acid and 1% Sulphuric acid; the goods are entered at 150° F., the bath heated to the boil in ½ an hour and the goods boiled for 1 hour; the bath is cooled to 122° F. Ammonia added until the liquid reacts neutrally, then the dyestuff solution poured in and the bath heated again to the boil; after boiling for ½ an hour, some Acetic acid is added and the goods boiled until the colours are exhausted.

Colours suitable for dyeing upon a Chrome mordant:

| | |
|--|--|
| Alizarine Yellow paste, 5G, GGW powder, GGW paste, RW powder, RW paste, Mordant Yellow O, Acid Alizarine Yellow RC, Alizarine Orange paste, powder, N paste, R paste, P paste, Alizarine Red, all paste brands, 1WS, 3WS, PS, Alizarine Claret R paste, Alizarine Brown paste, powder, R paste, R powder, S powder, RD powder, N paste, G paste, F paste, H paste, WR paste, Alizarine Blue B, F, A, DN, DNW, R, RR, 942, 942g, Alizarine Dark Blue S, SV, | Alizarine Blue SB paste, SB powder, SBW paste, SBW powder, SR paste, SR powder, SRW paste, SRW powder, SBR paste, SBR powder, S2R paste, SRX paste, Anthrol Blue NR, NG, Galleine paste A, paste R, paste R double, conc., W powder, Ceruleine paste A, paste SW, paste B, BR paste, conc., S, S conc., BWR, Alizarine Green S paste, Acid Alizarine Blue BB, GR, Alizarine Direct Blue B, Alizarine Direct Green G. |
|--|--|

Besides the above mentioned real Mordant colours, the following Chrome Developing dyestuffs can be used on a Chrome mordant, owing to their property of forming lakes with the Chromium Oxide deposited upon the fibre; they are therefore often used in combination with Mordant dyestuffs. Their lake formation is always more or less complete, still their fastness is considerably enhanced — and in some cases becomes perfect — if the dyed material is finally after-treated with $\frac{1}{4}$ — $\frac{1}{2}$ % Bichrome (provided of course that the Mordant dyestuffs employed, withstand this addition).

| | |
|--|--|
| Dianil Fast Red PH, Acid Alizarine Red G, B, Acid Alizarine Grenade R, Acid Alizarine Violet N, Acid Alizarine Brown R, B, BB, T, RH extra, RP, Fast Mordant Blue R, B, RT, BT, BBR, Acid Alizarine Blue WE, WEB conc., | Acid Alizarine Blue Black 3B, 3BN, A, Acid Alizarine Grey G, Acid Alizarine Black 3B extra, 3B, R, R extra, RG, RH, T, TG, AC, SE paste, SE powder, SET paste, SET powder, SN, SNT. |
|--|--|

Acid dyestuffs suitable for shading on Chrome Mordants:

The following equalise well and are fast to milling:

| | |
|---|--|
| Flavazine T, Fast Acid Violet B, R, A2R, BE, RGE, RBE, Fast Acid Magenta G, G conc., | Fast Acid Blue R, Milling Blue 2R extra, Acid Violet 5BF, Patent Blue A, AJ1, AF. |
|---|--|

The following also equalise well but are not fast to milling:

| | |
|--|---|
| Flavazine S, L, Azo Yellow O, conc., Victoria Yellow O, double, conc., Orange G, Nr. 2, Nr. 4, Brilliant Orange G, O, R, Azo Acid Red B, 5B, Amido Naphthol Red G, BB, 6B, | Azo Acid Carmine B, 5B, Fast Acid Eosine G, G extra, Fast Acid Phloxine A, A extra, Acid Violet N, 3RA, 6BL, 6BN, Alizarine Direct Blue E3B, EB, Naphtalene Green V, conc. |
|--|---|

VII. DYEING IN THE VAT.

Hitherto we have mentioned colours which are applied in dyeing as aqueous solutions, but we have now to discuss other dyestuffs which are insoluble in water and require a special process for making them suitable for dyeing.

Colours which are dyed in the vat are called Vat colours. They comprise dyestuffs which are first reduced to leuco-compounds; these are soluble in alkali and in this form are taken up by the fibre; they are then oxidised and reconverted into insoluble dyestuffs.

The process of applying Indigo in the blue vats has remained unaltered in principle for hundreds of years, but, about thirty years ago Schützenberger & Lalande invented a new method of Indigo dyeing by means of the so-called Hydrosulphite Vat. In spite of the various improvements, this vat could not effectively and generally compete against the older methods.

Only since the Farbwerke Hoechst introduced the Ammonia-Glue-Hydrosulphite-Vat has Indigo dyeing been led into new channels. This vat has quickly replaced the Fermentation and the older Hydrosulphite vats in all civilised countries. Whilst formerly only light shades could be dyed on loose wool which, moreover, turned out specky and uneven, it has now become possible to dye the lightest and deepest shades in the Hydrosulphite vat in a most rational and economic manner.

The advantages of the Hoechst Hydrosulphite vat over Fermentation vats are:

1. The vats are easily set and easily controlled.
2. The output is considerably increased.
3. Scarcely any loss of Indigo is possible.
4. All classes of wool are dyed solid.
5. The wool remains free from dust and is more pliable in spinning.
6. The blues do not rub as much as formerly, and also in milling considerably less Indigo is lost.

For wool dyeing purposes we have put on the market the following brands:

| | |
|------------------------|---------------------------|
| Indigo MLB paste pat. | Indigo White MLB/W pat. |
| Indigo MLB powder pat. | Indigo MLB Vat I 20% pat. |
| Indigo MLB grains | |

also

| | |
|---------------|-----------------------------|
| Indigo MLB/RR | Indigo MLB/R paste pat. |
| Indigo MLB/2B | Indigo MLB/R powder pat. |
| Indigo MLB/4B | Indigo MLB/R Vat I 20% pat. |

and the following Helindone colors:

| | |
|----------------------|---------------------------|
| Helindone Blue 2B, | Helindone Fast Scarlet R, |
| Helindone Grey 2B, | Helindone Orange R, D, |
| Helindone Red 3B, B, | Helindone Brown G, |

Indigo MLB/R is a derivative of Indigo. It has the same equalising properties as Indigo MLB, but yields much redder and brighter shades; its application is practically the same as that of Indigo MLB.

Hydrosulphite Vat.

a) Indigo MLB Vat I 20%.

The Hydrosulphite vat is prepared with a special preparation: Indigo MLB Vat I 20% and a very concentrated solution of Hydrosulphite O. For distant countries and also for hot climates, however, the latter is replaced by the very stable powder brand, Hydrosulphite conc. powder.

As the "Hoechst Vat" is quite clear and free from sediment the cisterns do not require to be as big as formerly, and need only allow sufficient room for handling the material. For loose wool, a rectangular wooden or iron cistern, similar to those used in yarn dyeing, is most suitable. It is fitted with a movable, perforated cage which can be lifted up at one end when the dyeing operation is finished, so that all the wool can be quickly removed without losing any of the dyeliquid. To the vat is also attached a squeezing appliance, through which the wool is passed before being oxidised.

For blueing 60 lbs. of wool, a cistern holding about 500—600 gallons is required, whilst for the same quantity of wool a Fermentation vat would have to be 3—4 times as large.

The Hydrosulphite vat is prepared in the following manner:

A cistern holding 600 gallons is filled with water, heated to 120° F., and then 1½—3 pints of Ammonia are added until the liquid shows a slightly alkaline reaction. Two gallons of a freshly prepared solution of Glue are then added (2 lbs. dry glue), and finally say 2—4 gallons of Indigo MLB Vat I mixed with 2—3 gallons of Hydrosulphite O, poured into the vat.

The liquid is well stirred and is then immediately ready for dyeing. The wool is entered, and moved under the surface of the liquid for 20—30 minutes, then it is lifted out of the vat with sticks or forks and immediately passed through the squeezing rollers. In order to get every particle of wool out of the vat, the inner cage is wound up, as described before. After squeezing, the wool is allowed to lie in a heap until the blue is properly developed, and if the shade is then not deep enough, a second dip is given in the same, or a slightly strengthened vat.

The following particulars will serve to indicate the additions which are required of Indigo MLB Vat I, Hydrosulphite and Ammonia:

| Shade | Indigo MLB Vat I | Hydro- sulphite O | Ammo- nia | Appear- ance of the Liquor | Reaction with Phenol- phtaleine |
|--------|------------------------|-------------------------|--------------|-------------------------------------|--|
| dark | much | little | none | dark green | only slightly alkaline |
| medium | equal | equal | little | green | weakly alkaline |
| light | little | much | much | yellowish- green | alkaline |

In figures the additions may be summed up as follows :

| Shade | Indigo MLB Vat I | Hydrosulphite O | Ammoma |
|--------|---------------------|-----------------|---------|
| dark | 3 gallons | 2 gallons | — |
| medium | 1½ gallons | 1½ gallons | 1 pint |
| light | 1—2 pints | 1 gallon | 3 pints |

Of course these proportions will not answer for all purposes; they have to be altered according to circumstances. The appearance and the reaction of the vat, as mentioned above in the first table, will in all cases serve as a useful guide.

In order to test the vat liquid for its alkalinity, one or two drops of alcoholic Phenolphthaleine solution are added to a test tube full of the liquid. The place of contact will momentarily appear red, which is the more pronounced the more alkaline the liquid reacts. If the alkalinity is very slight, only a faint pink will be visible, which will quickly disappear altogether.

These ammonia vats are worked (controlled) as easily as they are set.

The quantity of Indigo MLB Vat I added for the purpose of replenishing the vat, is varied according to the depth of shade to be produced. For dark shades it may be about one half, for light shades one fourth of the quantity first used. In the initial stages of working the vat, the quantity requisite for replenishing is somewhat greater.

Moreover, since coarse wool exhausts the vats much more readily than fine Botany wool, more Indigo Vat I is required when dyeing cross-breeds etc. etc.

The amount of Hydrosulphite required for replenishing is about one half to two thirds of the original quantity for each shade. If the vat is rested for a time (over-night for instance), the additions of Hydrosulphite have to be increased. It is also advisable to add a small quantity of Ammonia to the vats before covering them up, so as to retard the oxidation.

The quantity of Ammonia added to the vat is regulated by the shade to be produced and is readily estimated with the help of Phenolphthaleine. The more alkaline the vat liquid, the more slowly is the Indigo absorbed by the material, and the results thus obtained are more even. Consequently, for light shades the vat liquid requires more Ammonia than for dark shades. The latter are generally dyed evenly without any addition of Ammonia. Occasionally, however, Ammonia is added to the vats for dark colours when they have stood for some time unused, in order to counteract any acid reaction produced by the decomposition of the Hydrosulphite.

The continuous use of the vat causes the dye-liquid to become more or less contaminated by dirt and loss of Indigo. And naturally this takes place much sooner in ammonia than in fermentation vats, which contain at least three or four times the amount of liquid. Consequently it is advisable to renew the vat occasionally. No

appreciable loss is entailed by this renewal, as the vats can be completely exhausted by passing successive lots through them, for half a day, without any further addition of Indigo.

Practical experience has shown that a vat of about 600 gallons, after having had 3000—4000 lbs. of wool passed through it, requires renewal. This quantity of wool may easily be handled in a week's time.

The dyeing of slubbing, worsted yarn etc. in an open vessel is *entirely different* from the dyeing of loose wool by the difference in *the same apparatus is used as in loose wool dyeing*. The yarns are hung on cords, or better still on bent rods, and moved about under the liquid.

After finishing the dyeing one half after the other is taken out, and passed through the squeezing rollers. Light shades are at once immersed in cold water, whilst medium and dark shades are allowed to lie for some time after squeezing until the colour is oxidised.

For working in a mechanical apparatus where the material (loose wool, slubbing, yarn in banks or tops, etc.) is tightly packed whilst the vat liquid is circulated, it is desirable to dye even the darkest shades in one dip, so as to obviate the packing and unpacking of the material. For that purpose it is advisable to carry out the work as follows:

The vat liquid is prepared in the usual way, then the material is put into the apparatus, and the pump set in motion. After about 10 minutes, Bisulphite solution (mixed with equal parts of water) is added — preferably through a dripping funnel — until the vat shows a slightly acid reaction when tested with Phenolphthaleine solution. From the gradual lightening of the vat liquid, practical experience tells just how much Bisulphite is necessary in order to drive about four fifths of the Indigo in the vat on to the wool. As a rule $\frac{1}{4}$ — $\frac{1}{2}$ gallon is sufficient for 100 lbs of material. The whole dyeing operation takes from 20—30 minutes. The dyed material is then oxidised as rapidly as possible, generally with cold water.

After each operation, viz., before the vat can be used again, it must be neutralised by the addition of Ammonia, until a slight alkaline reaction is noticeable: 1—2 pints of Ammonia are generally sufficient. After neutralising, the necessary Hydrosulphite and Indigo MLB Vat I are again added, in order to produce the proper appearance of the liquid. For light and medium shades the souring with Bisulphite is dispensed with. For dyeing in a mechanical apparatus generally more Hydrosulphite is required than for dyeing in an open vessel.

If the dyeing of piece goods in the vat is to be carried out in a rational manner, a hawking machine and a wringer are necessary. Piece goods are now almost exclusively worked with a hawking machine, for hawking by hand often causes air stains and other defects, which are entirely obviated when employing a hawking machine which works well with a good squeezing appliance attached to it.

The vats must generally be made more alkaline for piece-dyeing than for wool, which causes the liquid to penetrate better and to produce more even results.

Before blueing, the pieces are evenly wetted in a washing machine, and then worked $\frac{1}{2}$ —2 $\frac{1}{2}$ hours in the vat. The duration

and number of dips depend on the quality of the goods. Hard, closely woven materials, require longer dips than loose fabrics. No more than two pieces of 80—100 yards can be dyed simultaneously in one vat.

After dyeing, the goods are well squeezed, plaited down and covered up, in order to keep them warm and retard the oxidation. This has a very beneficial effect upon the bloom. Sometimes the pieces are straightway aired after coming out of the vat, i. e. the oxidation is thus hurried on. Although the shades do not turn out as bright in this case as when the blue is slowly developed, this mode of working is specially advantageous for counteracting slight unevenness caused by faulty squeezing etc.

If the dyed pieces have to lie some time before they can be washed or given a second dip, it is advisable to pass them through warm water first. The blue dye-house, whether worked with Hydrosulphite or Fermentation vats, ought to be kept at an even, warm temperature.

We have quite recently further improved the process of Indigo dyeing by means of our Hoechst Soda-Hydrosulphite Vat.

The new method excels the older one as regards cheapness, it is moreover, free from the unpleasant smell of Ammonia, and finally it is handier inasmuch as Soda is much more easily obtained than Ammonia.

The vats do not impair the quality of the wool and the dyed shades are quite as fast as those obtained in the Ammonia Vat. In setting the vats two thirds of a part of Soda is added for every part of Ammonia. A vat holding 700 gallons requires:

| Shade | Indigo MLB Vat I | Hydrosulphite O | Soda calc. |
|--------|------------------|-----------------|-------------|
| dark | 3 gallons | 2 gallons | — |
| medium | 1½ „ | 1½ „ | 12 2/6 ozs. |
| light | 1/4 „ | 1 „ | 2 lbs. |

In working continuously, the proportion of 2/3 of Soda to 1 part of Ammonia is slightly altered: the amount of Soda is gradually decreased.

Indigo derivatives:

Indigo MLB/R, MLB/RR, and MLB/2B are dyed like Indigo MLB but require somewhat more alkali and hydrosulphite. When these products are dyed together with Indigo in a vat, comparatively larger quantities of the Indigo derivatives must be used for replenishing, as the fibre takes them up somewhat more readily than Indigo MLB. It is really better to dye in separate vats, first with Indigo MLB and then with the Indigo derivatives.

Indigo MLB/R is delivered in a reduced state under the name of Indigo MLB/R Vat I; the standard vats are prepared with the other brands as follows:

22 lbs. Paste dyestuff 20%.

¾ gal. Soda lye 77° Tw.

5 gals. Hydrosulphite O (6 lbs. Hydrosulphite conc. powder).

Heat up to 131—140° F. until dissolved.

The vats are set as in the case of Indigo MLB. The Indigo derivatives may also be dyed in the fermentation vat.

Helindone dyestuffs:

Helindone Blue BB, Helindone Red B, 3B, Helindone Fast Scarlet R, Helindone Orange R, Helindone Brown G, and Helindone Grey BB are dyed in the Hydrosulphite vat: The standard vats are set as follows:

| | Colour | Caustic Soda 76° Tw. | Hydro-sulphite conc. powder | Turkone oil. | Water at 140° F. |
|--------------------------------------|--------|-------------------------|-----------------------------------|---------------------|------------------------|
| Helindone Blue BB paste | 2 lbs. | $\frac{1}{2}$ pint | $6\frac{1}{2}$ ozs | $6\frac{1}{2}$ ozs. | 2 gall. |
| Helindone Red 3B . | 2 .. | $1\frac{1}{2}$ nog. | 8 .. | $6\frac{1}{2}$.. | 2 .. |
| Helindone Red B . | 2 .. | $\frac{1}{2}$ pint | $6\frac{1}{2}$.. | $6\frac{1}{2}$.. | 2 .. |
| Helindone Fast Scarlet R . . . | 4 .. | $\frac{3}{4}$.. | $6\frac{1}{2}$.. | $6\frac{1}{2}$.. | 2 .. |
| Helindone Orange R | 4 .. | $\frac{1}{2}$.. | $6\frac{1}{2}$.. | $6\frac{1}{2}$.. | 2 .. |
| Helindone Orange D | | | | | |
| Helindone Brown G | 4 .. | $\frac{1}{2}$.. | $6\frac{1}{2}$.. | $6\frac{1}{2}$.. | 2 .. |
| Helindone Grey BB | 2 .. | $\frac{1}{2}$.. | 11 .. | $6\frac{1}{2}$.. | 2 .. |

In the case of Helindone Grey BB an addition of $1\frac{3}{4}$ pints glue solution (1:10) is made to the standard vat:

The process of reduction lasts about $\frac{1}{2}$ hr. The condition of the vat is judged by dipping a sheet of glass into it and examining the colour of the solution which sticks to the glass.

Colour of the Standard vats:

Helindone Blue BB paste: Reddish yellow, immediately green, then turning blue.

Helindone Red 3B: Olive yellow, becoming slowly red.

Helindone Red B: Olive Yellow, becoming slowly red.

Helindone Fast Scarlet R, greenish olive, becoming slowly red.

Helindone Orange R, pale olive, becoming orange fairly quickly.

Helindone Brown G: pale yellowish brown, becoming slowly redder.

Helindone Grey BB: yellowish olive, becoming slowly bluish grey.

The dye vat (600 gals.) is prepared with:

3 lbs. Glue.

$2\frac{1}{2}$ pts. Ammonia.

2-3 lbs. Hydrosulphite conc. powder.

The water used for dyeing must be freed from lime and carbonic acid gas by means of soda and hydrosulphite. The dyeing is carried out at 140-149° F. in passages of about $\frac{1}{2}$ hr. After each passage the goods are well squeezed out and in order to avoid as much as possible their cooling down they are left to oxidise in baskets or boxes. Cold oxidation is harmful.

Helindone Brown G, Helindone Red B, Helindone Blue BB, and Helindone Orange R may be freely combined in the vat and

give very fast fashionable colours which are in no way inferior to the previous fast colour combinations, in fact they are superior to many of them on account of their great fastness to acids, and may therefore be used for shades absolutely fast to carbonising and acid milling (manufacture of hats). Staple shades are best dyed in one passage in an old bath. On the other hand, shades for which there is not a regular demand are best dyed in a fresh bath in two passages, as it is easier in this manner to dye to pattern and less dye remains in the bath than when dyeing in one passage. It is well to treat the goods with lukewarm dilute acetic acid after the oxidation and washing.

Fermentation Vat.

a) Indigo MLB.

Of the various kinds of Fermentation vats, the old woad vat still finds the most frequent employment, whilst the Soda vat is to be mentioned in the second place.

The soda vats are principally used for light shades, and the woad vats for dark heavy blues.

The setting and controlling of the blue vats with Indigo MLB is identical with that of natural Indigo.

| Soda vat. | Woad vat. |
|---------------------------|-------------------------|
| Contents: 2200 gallons. | Contents: 2200 gallons. |
| 17½ lbs. Madder | 132 lbs. Woad |
| 22 „ Syrup | 44 „ Madder |
| 66 „ Bran | 22 „ Solvay Soda |
| 44 „ Solvay Soda | 22 „ Syrup |
| 33 „ Indigo MLB paste 20% | 55 „ Bran |
| or 6½ „ Indigo MLB pdr. | 6½ „ Lime |
| | 44—55 „ Indigo MLB |
| | 20% paste |
| | or 8½—11 „ Indigo MLB |
| | powder. |

Indigo MLB powder must be well ground, in just the same manner as the natural product, before being used.

For the Soda vat the water must be heated to 120—140° F., for the woad vat to 150—160° F., before the addition of the necessary ingredients.

It is customary to soak the woad in warm water for a day before putting it into the vat. After all the ingredients have been added to the vat liquid it is well raked for some time, then covered up and allowed to rest for about 24 hours. In most cases a slight fermentation will set in after the expiration of this time; this can easily be observed, for, on pushing the rake into the sediment, some gas bubbles will rise to the surface and the liquid will begin to show a greenish tinge; moreover small blue veins will appear and a sickly smell become noticeable.

The vat liquid is again raked from time to time until the fermentation is well advanced, which takes place generally in 2—4 days. Then a small quantity of Lime is added so as to check the fermentation, without stopping it altogether. The vat liquid will appear yellowish-green, it shows small blue veins and contains a blue coppery

floth swimming on its surface. The vat has "come on" and must now be sharpened before the dyeing can begin.

At intervals of 1—2 hours small quantities of Lime are added to the vat and the liquid must be well stirred each time. In this manner the fermentation is retarded, the sickly odour becomes much more pungent, and the vat liquid appears yellow and is covered all over with a thick coppery flurry. Before starting, a small sample of wool is often immersed, to see whether the vat is in a workable condition and whether the "bluing" can be proceeded with.

The vat is replenished daily during the next few days with 10—20 lbs Indigo MLB paste or 2—4 lbs. Indigo MLB powder and the other necessary ingredients. Only one or two dyeing operations daily are to be carried out at first, until eventually, when the vat is sufficiently strong, a large output may be demanded from each vat. The temperature of the Soda vat should not exceed 120° F., whilst that of the Wood vat may reach 120—140° F.

It has been found by practical experience, that in using synthetic Indigo, less Lime is required for sharpening, than when working with plant Indigo.

b) Indigo White MLB/W.

Indigo White MLB/W is easily converted into a paste with water and, contrary to the ordinary Indigo, it is readily dissolved if the water is alkaline. It is therefore possible to work much more quickly with Indigo White MLB/W than with Indigo MLB or the natural product. Whilst the last are dissolved within 12—15 hours in the warm, and within 36—48 hours in the cold fermentation vat, Indigo White MLB/W requires only 2—3 hours to bring it into a workable condition. Owing to the solubility of Indigo White MLB/W, 2—3 additions may be made during a day, whilst when working with Indigo MLB or natural Indigo, only one addition can be made daily.

For the same reason exhausted vats can easily be brought back to their normal state, or at least be strengthened in such a way, that, e. g. dark shades can be dyed in the afternoon in a vat which yielded only light shades in the morning. In working a vat containing Indigo White MLB/W continuously, the necessary amount of fermentatives can be reduced to one third.

Indigo White MLB/W yields pro rata fuller shades than the natural product. Furthermore, in a vat worked with Indigo White MLB/W, a larger quantity of material (as much as 10% more) can be dyed, than in a vat of natural Indigo, so that the working with Indigo White MLB/W means greater output, less cost, and easier management of the vat.

If Indigo White MLB/W has to be added to the vat, it is made into a paste either with vat liquid or water and then 10% Lime of the weight of the Indigo are added. If the vat is very sharp, and therefore does not require any more Lime, the Indigo White MLB/W is added without any addition of Lime, after having been made into a paste.

For setting a fresh vat, any product which is able to bring about the fermentation may be used, e. g. old vat sediment, syrup, molasses, bread, bran, dates, rice flour etc. These ingredients are added to the vat liquid together with Lime. The mixture is allowed to rest until the fermentation begins.

When the fermentation has strongly advanced — which can easily be recognised by gas bubbles appearing on the surface of the vat liquid, and also by the peculiar sickly smell — the Indigo White MLB/W (made into a paste together with Lime) is added. Almost immediately a blue coppery froth will settle on the liquid. After a few hours the vat is sharpened in the usual manner. If Indigo White MLB/W is added together with the ordinary fermentatives, the froth will appear at once; the vat shows a dark, reddish-yellow colour which changes to greenish-blue after 6—12 hours. At this stage a considerable amount of gas bubbles will rise to the surface, the smell becomes more sickly, and the liquid gradually turns greenish-yellow in colour. After sharpening with Lime, the vat is ready for use.

Indigo White MLB/W is suitable for any kind of fermentation vat.

c) Indigo MLB Vat I.

Indigo MLB Vat I may also be used in the fermentation vat. It contains the Indigo in its reduced state, and the output of the fermentation vat can therefore be considerably increased, as no time is lost by reducing the Indigo in the vat itself. It may be added to a well-conditioned fermentation vat at any time and only very little or no Lime is required for sharpening it.

d) Indigo MLB/R, MLB/RRR, MLB/2B.

The fermentation of Indigo MLB/R etc. in the fermentation vat is similar to that of Indigo MLB; the only difference is, that these vats require rather more fermentatives and alkali. When working these vats uninterruptedly, Indigo MLB/R Vat I may be used in place of Indigo MLB/R 20%, in the same way as described under c.

Testing Indigo on the fibre.

The dyed patterns are submitted to two tests:

1. They are spotted with concentrated Nitric acid;
2. They are boiled for 5 minutes in Hydrochloric acid of 8° Tw.

Both tests are also applied to a comparative dyeing which contains only Indigo.

Pure Indigo, when spotted with Nitric acid shows a pure yellow spot; when boiled with Hydrochloric acid it is changed very little and does not stain the liquid. If the Nitric acid spot is reddish or brownish in shade, or if Muriatic acid alters the shade or is stained, other dyestuffs are present, possibly dyed in combination with Indigo.

Coloured wool effects and fancy shades in light and dark effects.

Under the German patent Nr. 137947 wool is treated with tannin and metal salts and thus rendered insensitive to certain acid and chrome developing dyestuffs. By using smaller quantities of

tannin and metal salts half resists are obtained: The following are the only products to be used for the dyeing of such prepared material:

| | |
|-------------------------------|----------------------------------|
| Flavazine T. | Victoria Violet 4BS, |
| Flavazine 3GL. | Azo Acid Blue B. |
| Alizarine Direct Blue E3BO. | Acid Green conc., |
| Chromotrope RR, | Azo Acid Black 3BE, |
| Azo Acid Carmine B, | Cyanine B, |
| Amido Naphthol Red G, BB, 6B, | Patent Blue L. V, } in small |
| Victoria Rubine O, | Naphthalene Green. } quantities. |
| New Cocaine O, | |

The prepared effects may be dyed with wool dyes which are fast to boiling acids. They may also be shaded in the piece with Basic dyes.

b) WOOL DYES CLASSIFIED ACCORDING TO SPECIFIC PROPERTIES:

1. Wool colours which may be dissolved in the acidified dye liquid without any danger of spots etc.

| | |
|--------------------------------|---------------------------------|
| Chinoline Yellow O, | Chromotene RR, 6B. |
| Naphthol Yellow S, | Violet 4BS, 4BSL, 8BS. |
| Flavazine 3GL, T, | Azo Acid Blue B, |
| Orange G, | Naphthalene Blue B, B extra, R, |
| New Coccine O, | Patent Marine Blue LE, |
| Nassovia Scarlet O, | Patent Blue V, N, superior, L, |
| Azo Acid Red B, 5B, | LE, |
| Amido Naphthol Red G, BB, 6B, | Cyanine B, B conc., |
| Sulpho Rosazine B, G, B extra, | Naphthalene Green V, V conc. |
| G extra, | |

2. Wool colours which must not be dissolved in the acidified dye liquid:

| | |
|-----------------------------|-------------------------------|
| Milling Yellow O, | Bleu de Lyon, |
| Milling Scarlet 4R conc., | Blackley Blue, |
| Fast Red O, | Guernsey Blue, |
| Rocceline N, | Opal Blue, |
| Cloth Red O, | Cloth Blue, |
| Alphyl Blue Black O, OK, | Full Blue O, |
| Tolyl Black BB, B, BG, | Deep Blue, |
| Black Blue O, | Alkaline Blue, |
| Nigrosine, | Methyl Alkaline Blue, |
| Fast Acid Violet, | Navy Blue, |
| Fast Acid Blue 3B, | Alkaline Violet, |
| Acid Rosamine A, | Alizarine Yellow GGW, |
| Milling Blue 2R extra. | Acid Alizarine Yellow RC, |
| Acid Violet R conc. new, N, | Acid Alizarine Blue WE, |
| 5BF, 5BFI, | Acid Alizarine Black SE, SET, |
| Neutral Violet O, | SN, SNT, |
| Neutral Blue R, 8R, | Chrome Black B, T, 2G, |
| Amido Black E, ET, A, AT, | Alizarine Brown, all powder |
| Pure Blue, | brands, |
| Soluble Blue, | Galleine conc., W powder, R |
| Light Blue. | conc. powder. |
| Cotton Blue. | |

3. Wool colours which leave cotton white in an acid bath

Acid dyes:

| | |
|-----------------------------------|-------------------------------|
| Chinoline Yellow O, extra, conc., | Scarlet 5R, 6R, |
| Naphthol Yellow S, SE, SL, | Scarlet Crystals 6R, |
| Flavazine 3GL, S, L, T, | Victoria Rubine O, |
| Orange G, | Naphthol Red O, |
| New Coccine O, | Azo Acid Brown RO, R conc., |
| Victoria Scarlet RR, 3R, 4R, | Amido Naphthol Red G, BB, 6B, |
| 5R, 6R, | Azo Acid Carmine B, |

Archil Substitute G.
 Chromotrope RR, BB, 8B, G,
 Vat dyes Violet 4BS, 4BSL,
 Naphthalene Blue B, B extra,
 Patent Marine Blue LE, V, LER,
 LEN,
 Azo Acid Black B, G, 3BL, BL,
 GL, TL conc., 3BL extra,
 Carbon Black B, B conc., BG,
 BD, T, 3B, E,
 Amido Black E, ET, A, AT,
 Fast Acid Eosine G, G extra,
 Fast Acid Phloxine A, A extra,
 Acid Magenta O, B, D, G, 3G,
 extra, extra B, N, M,
 Acid Maroon O,
 Sulpho Rosazine B, B extra,
 G, G extra.

Acid Violet 4RS, 3RS, 11, R
 conc., new, 6BL, 6BM,
 Patent Blue superior, N, L, V,
 Patent Pure Blue O,
 Cyanine B,
 Acid Green GI, O, conc., conc.
 D, M, conc. M,
 Naphthalene Green V, conc.,
 Naphthalene Dark Green B,
 Amido Dark Bottle Green B,
 Fast Acid Green BB, BB extra,
 BB extra conc.,
 Alizarine Direct Green G,
 Alizarine Direct Blue B, E3B,
 EB, ER extra,
 Alizarine Direct Violet R.

Developing dyestuffs:

Acid Alizarine Blue BB,
 Acid Alizarine Green G,
 Mordant Yellow O,
 Alizarine Yellow GGW, N,
 Alizarine Red 1WS,
 Acid Alizarine Red G, B,
 Acid Alizarine Grenade R,
 Acid Alizarine Violet N.

Acid Alizarine Brown RH extra,
 Chromogene I,
 Chromotrope FB, F4B, DW, S,
 SB, SR,
 Chromotrope Blue A,
 Fast Mordant Blue R, B,
 Acid Alizarine Blue Black A.

4. Wool dyes of good fastness to light:

Vat dyes:

| | |
|--------------------------------|---------------------------|
| Helindone Blue, MLB/R, MLB/RR, | Helindone Fast Scarlet R, |
| MLB 2B, | Helindone Orange R, |
| Helindone Blue 2B, | Helindone Brown G, |
| Helindone Red B, 3B, | Helindone Grey BB. |

Developing dyes:

| | |
|--------------------------------|----------------------------------|
| Alizarine Yellow 5G, GGW, | Fast Mordant Blue R, B, |
| RW, | Acid Alizarine Blue GR, BB, WE, |
| Mordant Yellow O, | Acid Alizarine Dark Blue SN, |
| Acid Alizarine Yellow RC, | Acid Alizarine Blue Black B, RB, |
| Dianil Fast Red PH, | 3B, A, |
| Alizarine Red 1WS, PS, | Acid Alizarine Black 3B extra, |
| Acid Alizarine Red G, B, | 3B, R, R extra, RG, RH, |
| Acid Alizarine Grenade R, | AC, T, TG, SE, SET, SN, |
| Acid Alizarine Violet N, | SNT, SLR, SER, SEN, |
| Acid Alizarine Brown R, B, BB, | SENR. |
| T, RH extra, RP, | Alizarine Orange N, R, P, (with |
| Chromogene I, | alum), |
| Chromotrope FB, F4B, DW, | Copper Red N, |
| S, SB, SR, | Copper Black S, SB. |
| Chromotrope Blue A, WB, WG, | |

Mordant dyes:

| | |
|---|---|
| Alizarine Yellow paste, 5G, GGW, RW, | Alizarine Brown, all brands, Fast Mordant Blue R, B, EG, |
| Mordant Yellow O, | Acid Alizarine Blue Black A, |
| Acid Alizarine Yellow RC, | Alizarine Blue, all brands. |
| Alizarine Orange paste, powder. | Alizarine Dark Blue S, SV, |
| N paste, R paste, P paste, | Anthrol Blue NR, NG, |
| Alizarine Red, all brands, | Ceruleine, all brands. |
| Alizarine Claret R paste, | |

Alizarine Direct Colors:

| | |
|---------------------------|--------------------------------|
| Alizarine Direct Green G, | Alizarine Direct Blue E3B, EB, |
| Alizarine Direct Blue B, | ER extra, |
| | Alizarine Direct Violet R. |

Acid dyes:

| | |
|----------------------------------|-----------------------|
| Flavazaine 3GL, L, | Fast Claret Red O, |
| Milling Yellow O, | Cloth Red O, |
| Brilliant Croceine yellow shade, | Amido Naphthol Red G, |
| bluish shade, R, B, BB, 3B, | Chromotrope RR. |
| 5B, 8B, | |

Dianil Colors:

| | |
|------------------------|-------------------|
| Cresotine Yellow G, | Dianil Crimson B. |
| Oxydianil Yellow G, O, | |

5. Wool colours fast to stoving:

Acid dyes:

| | |
|-----------------------------------|-----------------------------------|
| Chinoline Yellow O, extra, conc, | Azo Acid Blue B, |
| Naphthol Yellow S, SE, SL, | Azo Acid Black, all brands, |
| Flavazine 3GL, L, S, T, | Amido Black 10B, 10BO, E, ET, |
| Milling Yellow O, | Carbon Black B, BD, BG, T, |
| Victoria Yellow O, double, conc., | 3B, E, |
| Orange Nr. 4, G, Nr. 2, 2L, | Fast Dark Blue R, |
| Nr. 1, R, Nr. 4LL, | Fast Blue Black O, |
| Brilliant Orange G, O, R, | Milling Blue 2R extra, |
| Nassovia Scarlet O, | Fast Blue, all brands, |
| Milling Scarlet 4RO, 4R conc., | Acid Alizarine Grey G, |
| Scarlet G, R, RR, 3R, | Acid Rosamine A, |
| Brilliant Crimson O, B, | Fast Acid Red A, |
| Naphthol Red O, | Fast Acid Violet, all brands, |
| Azo Acid Brown RO, R conc., | Fast Acid Violet G, G extra, |
| Azo Acid Red B, 5B, | Fast Acid Phloxine A, A extra, |
| Amido Naphthol Red G, 6B, | Fast Acid Magenta G, G conc., |
| Azo Acid Carmine B, | Sulpho Rosazaine G, B, G extra, |
| Azo Acid Magenta G, B, | B extra, |
| Archil Substitute G, | Fast Acid Blue R, |
| Chromotrope G, RR, BB, 6B, | Rosazaine B, B extra, G, G extra, |
| S, 1:1, | O, extra, |
| Victoria Violet 4BS, 8BS, | Acid Violet N, 5BF, 5BFI, |

Neutral Violet O,
Neutral Blue R, 3R,
Patent Blue, all brands,
Patent Pure Blue O,

Cyanine B,
Naphthalene Green V conc.,
Fast Acid Green BB, BB extra,
Patent Green O, V, VVS, VS.

Dianil Colours:

Dianil Yellow 3G, R, RR,
Cresotine Yellow G,
Oxydianil Yellow G, O,

Aurophenine O, conc.,
Dianil Brown MH.

Alizarine Direct Colours:

Alizarine Direct Blue B, E3B,
EB, ER extra,

Alizarine Direct Green G,
Alizarine Direct Violet R.

Resorcine Colours:

Eosine, all brands,
Erythrosine, all brands,

Phloxine, all brands,
Rose Bengale, all brands.

Basic dyestuffs:

Auramine, conc., O, I, II,
Phosphine, all brands,
Rosazine, all brands,
Methylene Heliotrope O,
Methylene Violet, all brands,
Magenta, all brands,

New Magenta O,
Methyl Violet, all brands,
Violet Crystals O,
Victoria Blue B,
Brilliant Green, all brands.

Developing dyestuffs:

Alizarine Yellow 5G, GGW,
RW,
Mordant Yellow O,
Acid Alizarine Yellow RC,
Dianil Fast Red PH,
Alizarine Red IWS (with chrome),
Acid Alizarine Red G, B,
Acid Alizarine Grenade R,
Acid Alizarine Violet N,
Acid Alizarine Brown B,
Chrome Brown RO, BO,
Chromotrope FB, F4B, DW,
5G, 10B, S, SB, SR.

Chromotrope Blue A, WB, WG,
Fast Mordant Blue R, B, BT,
RT, BBR,
Acid Alizarine Blue GR, BB, WE,
Acid Alizarine Dark Blue SN,
Acid Alizarine Green G,
Acid Alizarine Grey G,
Acid Alizarine Blue Black B,
RB, 3B, A,
Acid Alizarine Black 3B extra,
3B, SE, SN,
Chrome Black 2G, B, T.

Mordant dyes:

Alizarine Yellow GGW,
Acid Alizarine Yellow RC,
Alizarine Orange paste, powder,
N paste, R paste, P paste,
Alizarine Red IWS (on chrome),

Alizarine Claret paste,
Alizarine Blue, all brands,
Ceruleine, all brands,
Fast Mordant Blue W, R.

Vat dyes:

Indigo MLB, MLB/R, MLB/RR,
MLB/2B,
Helindone Blue BB,
Helindone Red B, 3B,

Helindone Fast Scarlet R,
Helindone Brown G,
Helindone Orange R,
Helindone Grey BB,

6. Wool colours fast to boiling in acids:

Vat dyes:

| | |
|--|--|
| Indigo MLB, MLB/R, MLB/RR, MLB/2B, | Helindone Fast Scarlet R, Helindone Orange R, Helindone Brown G, Helindone Grey BB. |
| Helindone Blue BB, Helindone Red B, 3B, | |

Developing colours.

| | |
|--|---|
| Copper Blue B extra, Acid Alizarine Blue BB, Acid Alizarine Black SE, SET, SN, SNT, | Acid Alizarine Blue Black A, Chromogene I. |
|--|---|

Mordant dyes:

| | |
|-----------------------------|--|
| Alizarine Blue, all brands, | Ceruleine A paste, SW paste, S, conc. |
|-----------------------------|--|

7. Wool colours which are fast to washing:

Vat dyes:

| | |
|--|--|
| Indigo MLB, MLB/R, MLB/RR, MLB/2B, | Helindone Fast Scarlet R, Helindone Orange R, Helindone Brown G, Helindone Grey BB. |
| Helindone Blue 2B, Helindone Red B, 3B, | |

Developing dyes:

| | |
|--|--|
| Alizarine Yellow 5G, GGW, RW, Mordant Yellow, Acid Alizarine Yellow RC, Dianil Fast Red PH, Alizarine Red IWS, PS, Acid Alizarine Red G, B, Acid Alizarine Grenade R, Acid Alizarine Violet N, Acid Alizarine Brown R, B, BB, T, RH extra, RP, Chromogene I. Chromotrope FB, F4B, DW, 8B, 10B, S, SB, SR, Chromotrope Blue A, WB, WG, | Fast Mordant Blue R, B, BT, RT, BBR, Acid Alizarine Blue GR, BB, WE, Acid Alizarine Dark Blue SN, Acid Alizarine Green G, Ceruleine BR paste, B paste, BWR powder, Acid Alizarine Grey G, Acid Alizarine Blue Black B, RB, 3B, A, Acid Alizarine Black 3B extra, 3B, R, R extra, RG, RH, AC, T, TG, SE, SET, SN, SNT, Chrome Black 2G, B, T. |
|--|--|

Mordant dyes:

| | |
|---|---|
| Alizarine Yellow paste. 5G, GGW, RW, Mordant Yellow O, Acid Alizarine Yellow RC, Alizarine Orange paste, powder, N paste, R paste, P paste, Alizarine Red, all brands and IWS, PS, | Alizarine Claret R paste, Alizarine Brown, all brands, Alizarine Blue, all brands, Alizarine Dark Blue S, SV, Anthrol Blue NR, NG, Galleine, all brands, Ceruleine, all brands, Alizarine Green S paste. |
|---|---|

Alizarine Direct Colours:

| | |
|-------------------------------|----------------------------|
| Alizarine Direct Blue B, E3B, | Alizarine Direct Green G, |
| EB, RB extra, | Alizarine Direct Violet R. |

Acid dyes:

| | |
|-------------------------------------|--------------------------------|
| Milling Yellow O, | Fast Acid Phloxine A, A extra, |
| Chrysoine G, | Fast Acid Magenta G, G conc. |
| Scarlet R, RR, 3R, 4R, 5R, B extra, | Fast Acid Blue R, |
| Fast Claret Red O, | Acid Violet N, 5BF, 6BN, |
| Cloth Red O, | Neutral Violet O, |
| Azo Acid Carmine B, | Patent Blue A, AF, AJI, AN, |
| Victoria Violet 4BS, 8BS, | K, superior, extra, N, L, |
| Azo Acid Blue B, | LE, V, C, B, JI, JII, JIII, |
| Naphtalene Blue B, B extra, | EN, VN, J, RB, RBN. |
| Fast Blue, all brands, | Cyanine B, |
| Acid Rosamine A, | Indigo Substitute, all brands, |
| Fast Acid Violet B, R, A2R, | Naphtalene Green V, |
| Fast Acid Eosine, G, G extra, | Tolyl Black BB, B, BG. |

Basic dyes:

| | |
|--------------------------------|-------------------------|
| Rosazeine, all brands. | Violet Crystals O, |
| Methyl Violet, all blue brands | Victoria Blue B, R, 4R. |
| from BB on, | |

Resorcin dyes:

| | |
|--------------------------------|---------------------------------|
| All brands of Eosine, and Ery- | All brands of Phloxine and Rose |
| throsine, | Bengale. |

8. Wool dyes which are not affected by street dirt.

All our Wool dyes with the exception of all Alkaline Blues, Rosaniline Blues and the following dyestuffs:

| | |
|--------------------------------|------------------------------|
| Acid Magenta O, B, D, G, GG, | D, N conc., M solution, |
| 3G, extra, extra B, N, M, | 5fold conc., |
| Acid Cerise O, II, | Methylene Yellow H, |
| Acid Maroon O, | Malachite Green, all brands. |
| Maroon S, | Brilliant Green, all brands. |
| Acid Green GI, O, conc., conc. | |

9. Wool dyes for cold water milling:

Acid dyes:

| | |
|-----------------------------------|--------------------------------|
| Flavazine T, | Victoria Scarlet G, R, RR, 3R, |
| Milling Yellow O, | 4R, 5R, 6R, |
| Chrysoine G, R, | Scarlet R, RR, 3R, 4R, 5R, |
| Victoria Yellow O, double, conc., | 6R, B extra, |
| conc. D, | Scarlet Crystals 6R, |
| Brilliant Orange G, O, R, | Fast Red O, S, |
| Brilliant Croceine yellow shade, | Rocceline N, |
| blue shade, R, B, BB, 3B, | Brilliant Crimson O, B, |
| 5B, 8B, | Victoria Rubine O, |
| Nassovia Scarlet O, | Naphthol Red O, |
| Milling Scarlet 4RO, 4R conc., | Amaranth O, |

| | |
|--|---|
| Claret Red G, B, R, G extra, R extra, | Acid Alizarine Grey G, |
| Fast Claret Red O, | Acid Rosamine A, |
| Naphtho Rubine O, | Fast Acid Violet B, R, ARR, |
| Cloth Red O, | Fast Acid Eosine G, G extra, |
| Azo Brown V, | Fast Acid Magenta G, G conc., |
| Azo Acid Red B, 5B, | Sulpho Rosazaine B, B extra, |
| Amido Naphthol Red G, BB, 6B, | Fast Acid Blue 3B, |
| Azo Acid Carmine B, 3BO, 3B conc., | Alizarine Direct Blue B, EB, |
| Naphtalene Blue B, B extra, | Alizarine Direct Green G, |
| Naphtalene Dark Blue EG extra, | Alizarine Direct Violet R, |
| Alphyle Blue Black O, K, | Rosazaine B, B extra, G, G extra, O extra, |
| Amido Black 10B, 10BO, 3B, T, E, ET, A, AT, | Acid Violet 5BF, 6BN, |
| Carbon Black B, B conc., BD, BG, T, 3B, E, | Neutral Violet O, |
| Tolyl Black BB, B, BG, | Neutral Blue R, 3R, |
| | Patent Blue A, AF, AJI, AN, |
| | Indigo Substitute WE, |
| | Naphtalene Green V, conc. |

Alkaline Blues:

| | |
|-------------------------------|-----------------------------|
| Methyl Alkaline Blue MLB, | 3B, BBR, B, R, R conc., RR, |
| Alkaline Blue 7B, 6B, 5B, 4B, | Alkaline Violet O. |

Resorcine dyes:

| | |
|--------------|----------------------------------|
| Eosine. | Phloxine, and all brands of Rose |
| Erythrosine, | Bengale. |

All Dianil colors which are used on wool (on cotton they bleed), and all Mordant, Developing and Vat dyes.

10. Wool colours suitable for light milling in soap.

All Developing, Mordant and Vat Dyestuffs, and the following

Acid dyes:

| | |
|--|--|
| Chinoline Yellow O, extra, conc., | Azo Acid Blue B, 3BO, 3B conc |
| Flavazine T, | Naphtalene Blue B, B extra, |
| Mulling Yellow O, | Amido Black 10B, 10BO, |
| Chrysone GR, | Amido Naphthol Black S, 6B, |
| Brilliant Croceine yellow shade, blue shade, R, B, BB, 3B, 5B, 8B, | 6B conc., 4B, 4B extra, 4B conc., 4BH, BX, B conc., RK, M conc., |
| Milling Scarlet 4RO, 4R conc., | Fast Dark Blue B extra, B extra conc., R, |
| Scarlet R, RR, 3R, 4R, 5R, 6R, B extra, | Milling Blue 2R extra, |
| Scarlet Crystals 6R, | Fast Acid Black, all brands, |
| Fast Red O, S, | Tolyl Black BB. |
| Claret Red extra, | Fast Blue O soluble in water, R, RR, 3R extra, D, G extra, V, greenish, extra greenish. |
| Cloth Red O, | Nigrosine Nr. 1, Nr. 4, |
| Fast Claret Red O, | Acid Alizarine Grey G, |
| Azo Acid Carmine B, | Acid Rosamine A, |
| Chromotrope RR, BB, 6B, 8B, 10B, | |
| Victoria Violet 4BS, 8BS, | |

| | |
|--------------------------------|-----------------------------|
| Fast Acid Violet B, R, ARR. | Neutral Blue R, 3R, |
| Fast Acid Eosine G, G extra. | Victoria Blue B, R, 4R. |
| Fast Acid Phloxine A, A extra. | Patent Blue A, AS, AJI, AN, |
| Fast Acid Magenta G, G conc., | Indigo Substitute WE, |
| Fast Acid Blue R, | Naphtalene Green V, conc., |
| Rosazeine B, B extra, G, G | Alizarine Direct Green G, |
| extra, O extra, | Alizarine Direct Blue B, |
| Acid Violet N, 5BF, | Alizarine Direct Violet R. |
| Neutral Violet O, | |

Dianil Colours:

(bleed on cotton)

| | |
|----------------------------|----------------------------------|
| Dianil Pure Yellow HS, | Brilliant Dianil Red R, |
| Dianil Yellow 3G, R, RB. | Dianil Fast Red PH, |
| Cresotine Yellow G, | Dianil Fast Scarlet, all brands, |
| Oxydianil Yellow G, O, | Dianil Crimson B, G, |
| Aurophenine O, conc., | Dianil Violet H. |
| Dianil Orange N, G, | Dianil Brown 3GO, G, 2G, MH, |
| Dianil Red R, 4B, 6B, 10B, | BD, R, 3R, B, D, |
| Delta Purpurine 5B, | Dianil Fast Brown B. |

Alkaline Blues:

(must be dyed in an acid bath)

| | |
|-----------------------------------|--------------------------|
| Methyl Alkaline Blue MLB, | BB, BBR, R, R conc., RR, |
| Alkaline Blue 7B, 6B, 5B, 4B, 3B, | Alkaline Violet O. |

Resorcine dyes:

| | |
|--------------------|----------------------------|
| All brands Eosine, | Phloxine and Rose Bengale. |
| Erythrosine, | |

Basic dyes:

| | |
|-------------------------------|-------------------------------|
| Rosazeine B, B extra, G, G | New Magenta O, |
| extra, O extra, 4B extra, | Methyl Violet 5R superior, 3R |
| 6G, 6G extra, 6GD, 6GD | superior, R superior, B su- |
| extra, | peior, BB, 4B, |
| Safranine, all brands, | Violet Crystals O, |
| Methylene Violet, all brands, | Victoria Blue B, R, 4R. |
| Magenta, all brands, | |

11. Wool colours suitable for the ordinary milling process (Buckskins).

Developing dyes:

| | |
|---------------------------|---------------------------------|
| Alizarine Yellow 5G, GGW, | Acid Alizarine Violet N, |
| RW, | Acid Alizarine Brown, R, RR, |
| Mordant Yellow O, conc., | B, BB, T, RH extra, RP, |
| Acid Alizarine Yellow RC, | Chromogene I, |
| Dianil Fast Red PH, | Chrome Brown RO, BO, |
| Alizarine Red IWS, PS, | Chromotrope FB, F4B, DW, S, |
| Acid Alizarine Red G, B, | Chromotrope Blue WB, WG, |
| Acid Alizarine Grenade R, | Fast Mordant Blue R, B, BT, RT, |

| | |
|------------------------------|---------------------------------|
| Acid Alizarine Green G, | extra, R, R extra, RG, RH, |
| Ceruleine BR paste, B paste, | AC, T, TG, SE, SET, SN, |
| BRW powder, | SNT, |
| Acid Alizarine Grey G, | Chrome Black B, T, |
| Acid Alizarine Blue Black B, | Alizarine Orange N, R, P. (with |
| RB, 3B, A, | alum). |
| Acid Alizarine Black 3B, 3B | |

Mordant dyes:

| | |
|---------------------------------|------------------------------|
| Alizarine Yellow paste, 5G, | Alizarine Brown, all brands, |
| GGW, RW, | Alizarine Blue, all brands, |
| Mordant Yellow O, | Alizarine Dark Blue S, SV, |
| Acid Alizarine Yellow RC, | Anthrol Blue NR, NG, |
| Alizarine Orange paste, powder, | Galleine, all brands, |
| N paste, R paste, P paste, | Ceruleine, all brands, |
| Alizarine Red, all brands, | Alizarine Green S paste, |
| Alizarine Claret R paste, | Acid Alizarine Blue Black B. |

Vat dyes:

| | |
|----------------------------|---------------------|
| Indigo MLB, MLB/R, MLB/RR, | Helindone Orange R, |
| MLB/2B, | Helindone Brown G, |
| Helindone Red B, 3B, | Helindone Blue BB. |
| Helindone Fast Scarlet R, | |

Dianil dyestuffs:

(Bleed on Cotton)

| | |
|----------------------------|----------------------------------|
| Dianil Pure Yellow HS, | Dianil Fast Red PH, |
| Dianil Yellow 3G, R, RB, | Dianil Fast Scarlet, all brands, |
| Cresotine Yellow G, | Dianil Crimson B, G, |
| Oxydianil Yellow G, O, | Dianil Claret B, G, |
| Autophenine O. conc. | Dianil Violet H, |
| Dianil Orange N, G, | Dianil Brown 3GO, G, 2G, |
| Dianil Red R, 4B, 6B, 10B, | MH, BG, R, 3R, B, D. |
| Delta Purpurine 5B, | Dianil Fast Brown B. |
| Dianil Brilliant Red. R, | |

Alizarine Direct Colours:

| | |
|---------------------------|--------------------------|
| Alizarine Direct Green G, | Alizarine Direct Blue B. |
|---------------------------|--------------------------|

Acid dyestuffs:

(Aftertreated with metal-salts or used in small quantities for shading)

| | |
|-------------------------------|-----------------------------|
| Milling Yellow O, | Fast Acid Violet R, A2R, |
| Milling Scarlet 4RO, 4R conc. | Fast Acid Blue R, |
| Milling Blue 2 R extra, | Acid Violet 5BF, 5BFAI, |
| Acid Alizarine Grey G, | Patent Blue A, AF, AJI, AN, |
| Acid Rosamine A, | A2R, A4R. |

12. Wool Colours suitable for very severe milling.

Developing dyestuffs:

| | |
|-------------------------------|------------------------|
| Alizarine Yellow 5G, GGW, RW, | Dianil Fast Red PH, |
| Mordant Yellow O, conc. N, | Alizarine Red IWS, PS, |
| Acid Alizarine Yellow RC, | Acid Alizarine Red G, |

| | |
|-----------------------------|--------------------------------|
| Acid Alizarine Grenade R, | Acid Alizarine Black SE paste, |
| Acid Alizarine Violet TN, | SE powder, SET paste, |
| Acid Alizarine Brown RR, B, | SET powder, SN, SNT, SK, |
| BB, T, RH, extra RP, | SKT, |
| Chromogene I, | Alizarine Orange N, R, T. |
| Fast Mordant Blue R, B, | |

Mordant dyestuffs:

| | |
|---------------------------------|------------------------------|
| Alizarine Yellow paste 5G, | Alizarine Claret R paste, |
| GGW, RW, | Alizarine Brown, all brands, |
| Mordant Yellow O, | Alizarine Blue, all brands, |
| Acid Alizarine Yellow RC, | Alizarine Dark Blue S. SV, |
| Alizarine Orange paste, powder, | Galleine, all brands, |
| N paste, R paste, T paste. | Ceruleine, all brands, |
| Alizarine Red, all brands, | Alizarine Green S Paste. |

Vat dyestuffs:

| | |
|----------------------------|---------------------------------|
| Indigo MLB, MLB/R, MLB/RR, | Helindone Fast Scarlet S Paste, |
| MLB/2B, | Helindone Orange R, |
| Helindone Blue BB, | Helindone Brown G, |
| Helindone Red B, 3B, | Helindone Grey BB. |

13. Wool Colours which withstand dry steaming.

All Dyestuffs with the exception of:

| | |
|-----------------------------|----------------------|
| Auramine. | Soluble Blue, |
| Malachite Green, | Cotton Blue, |
| Brilliant Green, | Azo Yellow, |
| Acid Green, | Scarlet 5R, B extra, |
| Acid Magenta, | Brilliant Croceine, |
| Acid Violet 4RS, 3RS, II, R | Paper Scarlet, |
| conc. new, | Chromotrope 7B, 2B. |
| Alkaline Blue, | |

14. Wool Colours which withstand wet steaming.

Developing dyestuffs:

| | |
|-----------------------------|---------------------------------|
| Alizarine Yellow 5G, GGW, | Chromogene I, |
| RW, | Fast Mordant Blue R, B, BT, RT, |
| Mordant Yellow O, conc., N, | Acid Alizarine Blue BB, with |
| Acid Alizarine Yellow RC, | bichrome. |
| Alizarine Red IW, PS, | Acid Alizarine Grey G, with |
| Acid Alizarine Red G, | bichrome, |
| Acid Alizarine Grenade R, | Acid Alizarine Blue Black 3B, |
| Acid Alizarine Brown B, BB, | Acid Alizarine Black SE, SET, |
| T, RP. | SN, SNT. |

Mordant dyestuffs:

| | |
|----------------------------|---------------------------------|
| Alizarine Yellow paste 5G, | Acid Alizarine Yellow RC, |
| GGW, RW. | Alizarine Orange paste, powder, |
| Mordant Yellow O, | N paste, R paste, P paste. |

| | |
|------------------------------|--------------------------|
| Alizarine Red, all brands, | Alizarine Dark Blue S. |
| Alizarine Claret R paste, | Galleine, all brands, |
| Alizarine Brown, all brands, | Alizarine Green S paste. |
| Alizarine Blue, all brands, | |

Vat dyestuffs:

| | |
|----------------------------|---------------------|
| Indigo MLB, MLB/R, MLB/RR, | Helindone Orange R, |
| MLB/2B, | Helindone Brown G, |
| Helindone Red B, 3B, | Helindone Blue BB, |
| Helindone Fast Scarlet R, | Helindone Grey BB. |

15. Wool Colours which may be carbonised with Sulphuric acid, and are fast to milling:

Developing dyestuffs:

| | |
|-------------------------------|----------------------------------|
| Acid Alizarine Red G, | Fast Mordant Blue R, B, |
| Acid Alizarine Grenade R, | Acid Alizarine Blue BB, |
| Acid Alizarine Violet N, | bichrome, |
| Acid Alizarine Brown RR, R, | Acid Alizarine Green G, |
| B, BB, T, RH extra, RT, | Acid Alizarine Grey G, |
| Chromogene I, | Acid Alizarine Blue Black 3B, A, |
| Chrome Brown RO, BO, with | Acid Alizarine Black SE, SET, |
| bichrome and lactic acid, | SN, SNT, |
| Chromotrope FB, F4B, DW, with | Chrome Black 2G, B, T. |
| bichrome and lactic acid, | |

Mordant dyestuffs:

| | |
|---------------------------------|-----------------------------|
| Alizarine Orange paste, powder, | Alizarine Blue, all brands, |
| N paste, R paste, P paste, | Alizarine Dark Blue S, |
| Alizarine Claret R paste, | Ceruleine conc. S, S conc. |

Vat dyestuffs:

| | |
|----------------------------|---------------------------|
| Indigo MLB, MLB/R, MLB/RR, | Helindone Fast Scarlet R, |
| MLB/2B, | Helindone Orange R, |
| Helindone Blue BB, | Helindone Brown G, |
| Helindone Red B, 3B, | Helindone Grey BB. |

Acid dyestuffs:

| | |
|---------------------------|-----------------------------|
| Alizarine Direct Green G, | Patent Blue A, |
| Alizarine Direct Blue B, | Fast Acid Violet A2R, R, B, |
| Milling Yellow O, | Fast Acid Blue R. |

16. Wool Colours suitable for piece dyeing and carbonising with Sulphuric acid.

All Colours with the exception of:

| | |
|--------------------------|-------------------------------|
| Eosine, all brands, | Alizarine Yellow paste, |
| Erythrosine, all brands, | Ceruleine B paste, BWR paste, |
| Copper Red N, | BWR conc., |
| Mordant Yellow O, | Phloxine, all brands, |

Rose Bengale, all brands,
Copper Black S,
Copper Blue B, B extra,

Alizarine Red, all brands on
Chrome and Alum Mordant,
Alizarine Brown, all brands,
Galleine, all brands.

17. Wool Colours giving a yellow Nitric acid reaction:

Erythrosine, all brands,
Phloxine, all brands,
Rose Bengale, all brands,
Indigo Substitute B, BS, WE
(dull yellow),
Acid Magenta, all brands.
Acid Violet 4RS, 3RS, N, 5BF,
5BF1,
Neutral Violet O,
Soluble Blue SV,
Acid Green, all brands (dull
yellow),
Patent Blue V, N, L. superior, B,
Patent Blue, J brands, A, AJI,
(dull yellow),
Patent Green O. V, VS (dull
yellow),
Cyanine B,

Naphtalene Green V, conc,
(orange yellow),
Flavazine S, L, T,
Chromotrope RR,
Azo Acid Carmine B (dull yellow
with blueish rim),
Alizarine Red 1WS, (on Alum
Mordant or developed with
Alum),
Alizarine Blue, all brands (dull
yellow),
Alizarine Direct Blue,
Galleine, all brands (dull yellow),
Ceruleine conc., S, S conc., paste
A, paste SW (reddish yellow),
Indigo MLB, MLB/R, MLB/RR,
MLB/2B,
Helindone Blue BB.

18. Wool Colours which change only slightly or not at all when spotted with Muriatic acid:

Acid Violet 3RS, 4RS,
Methyl Alkaline Blue MLB,
Alkaline Blue BB—6B,
Opal Blue, blueish, greenish,
superior soluble,
Fast Blue, all brands,
Black Blue O,
Fast Dark Blue R,
Alizarine Direct Blue B, E3B, EB,
Alizarine Direct Violet R,
Alizarine Direct Green G,
Scarlet 6R crystals,
Victoria Scarlet, all brands,
New Coccine O,
Coccine O, B,
Victoria Rubine O, G,
Brilliant Rubine O,
Brilliant Crimson O, B,
Naphthol Red O,
Amaranth, all brands,
Claret Red G, G extra,
Fast Brown O,

Fast Acid Eosine G, G extra,
GG extra,
Fast Acid Phloxine A,
Fast Acid Magenta G,
Fast Acid Violet R, A2R,
Acid Rosamine A,
Fast Acid Blue R, R conc.,
Chinoline Yellow O,
Flavazine S, L, T,
Orange G, R, No. 2,
Brilliant Orange G, O,
Scarlet, all brands, GG—4R, 6R,
Acid Alizarine Violet N,
Acid Alizarine Brown, all brands,
Acid Alizarine Grenade R,
Acid Alizarine Grey G,
Acid Alizarine Blue Black B, 3B,
Archil Substitute G,
Chromotrope 2R, 2B, 8B, 10B,
Amido Naphthol Red G, 6B,
Amido Naphthol Black 4B, 4B
extra, 6B, S,

| | |
|--|-----------------------------|
| Amido Black, all brands, | Alizarine Blue, all brands, |
| Chromogene I, | Fast Acid Blue R, RR |
| Chrome Brown RO, BO, | MLB, 2B, |
| Chrome Black B, T, | Helindone Blue 2B, |
| Chromotrope 7B, 8B, 10B, S, | Helindone Red B, 3B, |
| DW, SR, FB, F4B (developed with Bichrome), | Helindone Fast Scarlet R, |
| Acid Alizarine Red G, B, | Helindone Orange R, |
| Acid Alizarine Black R, 3B, | Helindone Brown G, |
| 3B extra, T, SE, SET, SN, | Helindone Grey BB, |
| SNT, | Fast Mordant Blue B, R |

19. Wool Colours suitable for acid milling.

| | |
|----------------------------------|------------------------------------|
| Indigo MLB, MLB/R, MLB/RR, | Acid Alizarine Blue BB, |
| MLB/2B, | Acid Alizarine Dark Blue SN, |
| Helindone Blue 2B, | Alizarine Direct Blue B, |
| Helindone Red B, 3B, | Alizarine Direct Green G, |
| Helindone Fast Scarlet R, | Acid Alizarine Green G, |
| Helindone Orange R, | Alizarine Blue, all brands, |
| Helindone Brown G, | Ceruleine conc., S. S conc., paste |
| Helindone Grey BB, | A, paste SW, |
| Fast Mordant Blue B, R, | Acid Alizarine Grenade R, |
| Chromotrope S, SR, FB, F4B, | Acid Alizarine Red G, B, |
| DW, | Acid Alizarine Violet N, |
| Chrome Brown RO, BO, | Acid Alizarine Grey G, |
| Chromogene I, | Fast Acid Blue R, R conc., |
| Chrome Black B, | Fast Acid Violet R, A2R, |
| Acid Alizarine Black R, SE, SN, | Patent Blue A, |
| Acid Alizarine Blue Black B, 3B, | Flavazine T. |

20. Wool Colours which can be dyed in copper vessels only if Sulpho-Cyanide of Ammonia is added.

| | |
|--------------------------------|----------------------------------|
| Naphtalene Blue B, B extra, D, | Acid Alizarine Blue BB, GR, |
| Victoria Violet 4BS, SBS, | Acid Alizarine Dark Blue SN, |
| Azo Acid Blue B, | Alizarine Direct Violet R, |
| Azo Acid Black, all brands, | Acid Alizarine Green G, |
| Chromotrope FB, F4B, DW, | Acid Alizarine Blue Black B, 3B, |
| Acid Alizarine Black R, 3B, | Fast Mordant Blue B, R, |
| 3B extra, T, | Acid Alizarine Brown RP. |

21. Wool Colours which are specially suitable for mechanical dyeing apparatus.

Developing dyestuffs:

| | |
|---------------------------|-------------------------------|
| Alizarine Yellow GGW, | Acid Alizarine Violet N, |
| Mordant Yellow O, | Acid Alizarine Grey R, B, BB, |
| Acid Alizarine Yellow RC, | T, RH extra, RP, |
| Dianil Fast Red PH, | Chromogene I, |
| Alizarine Red 1PS, PS, | Chromotrope FB, F4B, DW, S, |
| Acid Alizarine Red G, B, | SB, SR, |
| Acid Alizarine Grenade R, | Chromotrope Blue A, WB, WD, |

| | |
|---|--|
| Fast Mordant Blue R, B, BT, RT, BBR, | Acid Alizarine Blue Black B, 3B, A, |
| Acid Alizarine Blue BB, | Acid Alizarine Black 3B extra, |
| Acid Alizarine Green G, | 3B, T, SN, SNT, |
| Acid Alizarine Grey G, | Chrome Black B, T. |

Mordant dyestuffs:

| | |
|---|------------------------------------|
| Alizarine Yellow GGW, RW, | Alizarine Red, all brands, |
| Mordant Yellow O, | Alizarine Claret R paste, |
| Acid Alizarine Yellow RC, | Alizarine Brown, all brands, |
| Alizarine Orange paste, powder, N paste, R paste, P paste. | Alizarine Blue S brands and DNW |

Vat dyestuffs

| | |
|---------------------------------------|---------------------------|
| Indigo MLB, MLB/R, MLB'RR, MLB/2B, | Helindone Fast Scarlet R, |
| Helindone Blue BB, | Helindone Orange R, |
| Helindone Red B, 3B, | Helindone Brown G, |
| | Helindone Grey BB. |

Acid dyestuffs:

Most Acid dyestuffs such as:

| | |
|--------------------------------------|--------------------------|
| Alizarine Direct Green G, | Patent Blue A, |
| Alizarine Direct Blue B, E3B, EB, | Fast Acid Blue R, |
| Alizarine Direct Violet R, | Fast Acid Violet A2R, |
| | Amidonaphthol Red G, 6B. |

22. Action of Hydrosulphite on Wool colors.

A number of Wool Colours can be partly or entirely destroyed and stripped from the fibre, by means of Hydrosulphite. Of these preparations, Hydrosulphite AZ and Hydrosulphite NF or NF conc. Hoechst, may be used.

For 100 lbs. of wool, the stripping bath is prepared with 3 lbs. of Hydrosulphite AZ, 3 lbs. Acetic acid (or 1½ lbs. Formic acid 85%) or 2 lbs. Sulphuric acid 169° Tw.). The wool is entered into a luke-warm bath, which is then slowly heated to the boil. After boiling for ½–¾ of an hour the stripping is completed, and the material must then be well rinsed.

According to the action of the Hydrosulphite, colouring matters can be divided into the following groups:

1. Colours which are only slightly affected, i. e. the shade becomes slightly lighter or remains intact. e. g. Logwood Chrome Black.
2. The shades become noticeably lighter but the colour is not actually destroyed, e. g. Acid Alizarine Black R.
The colour is partly destroyed but generally a remnant of colouring matter, mostly brown, remains on the fibre, e. g. Naphthalene Blue B.
4. The colour is almost completely destroyed
- 5a. The colour is destroyed, but on being left to lie returns partly, e. g. Acid Violet N
- 5b. hardly any colour returns, e. g. Patent Blue V.
6. The colour is entirely and permanently destroyed.

The figures in brackets after each individual dyestuff refer to the method of dyeing:

SCr: Dyed in a Sulphuric acid bath and developed with Bichrome.

CrV: Dyed on a Chrome Moriant.

AlV: Dyed on an Alum Moriant

SCrM: Dyed in a Sulphuric acid bath and developed with Bichrome and Lactic acid.

SFl: Dyed in a Sulphuric acid bath and developed with Fluoride of Chrome.

E: Dyed in an Acetic acid bath.

| | | | |
|--|----|--|----|
| Acid Alizarine Blue BB, GR (SFl, CrV) . . . | 1 | Alizarine Yellow GGW (SCr) . . . | 3 |
| Acid Alizarine Blue WE | 2 | Alizarine Yellow GGW (CrV) . . . | 3 |
| Acid Alizarine Blue Black B, BS | 3 | Alizarine Claret R paste . | 1 |
| Acid Alizarine Brown B, BB, T | 2 | Alizarine Green S paste . | 1 |
| Acid Alizarine Dark Blue SN (SFl, CrV) . . . | 1 | Alizarine Orange N paste (AlV, CrV) . . . | 1 |
| Acid Alizarine Yellow RC (ECr, CrV) | 3 | Alizarine Red, all brands | 1 |
| Acid Alizarine Grenade R | 2 | Alkaline Blue, all brands | 1 |
| Acid Alizarine Grey G (E, ECr) | 3 | Alkaline Violet O . . . | 5a |
| Acid Alizarine Green G (SCr, SFl) | 1 | Alphyl Blue Black O . . | 3 |
| Acid Alizarine Red B . | 2 | Amido Naphthol Red BB, 6B, G | 6 |
| Acid Alizarine Red G . | 1 | Amido Naphthol Black 4B, 6B, RK | 3 |
| Acid Alizarine Black SE paste, SET, SN, SNT | 1 | Anthrol Blue NR paste . | 1 |
| Acid Alizarine Violet N | 2 | Auramine O | 2 |
| Acid Magenta G | 4 | Azo Yellow conc. | 4 |
| Acid Magenta B, extra, M, O | 6 | Azo Acid Blue B, 3B conc. | 3 |
| Acid Green conc, conc. M | 5b | Azo Acid Carmine B . . | 6 |
| Acid Maroon O | 4 | Azo Acid Magenta B, G | 3 |
| Acid Violet 3RA | 4 | Azo Acid Red B | 6 |
| Acid Violet 5BF, N, R conc new | 5a | Azo Acid Black, all brands | 3 |
| Acid Violet 4RS | 6 | Black Blue O | 2 |
| Acid Rosamine A | 1 | Blue Blueish | 5b |
| Alizarine Blue, all brands | 1 | Bleu de Lyon O | 5b |
| Alizarine Brown paste, F paste | 1 | Brilliant Crimson O . . | 4 |
| Alizarine Direct Blue E, EB, E3B | 2 | Brilliant Croceine 3B, blueish, yellowish . . | 4 |
| Alizarine Direct Green G | 2 | Brilliant Green | 5b |
| Alizarine Direct Violet R | 2 | Brilliant Orange G, R, O | 6 |
| Alizarine Dark Blue Spaste | 1 | Carbon Black B, BD, 3B | 3 |
| Alizarine Yellow paste . | 1 | Cerise G | 3 |
| | | Ceruleine, all brands . . | 1 |
| | | Chinoline Yellow O . . | 1 |
| | | Chrome Brown RO (SCr) | 2 |
| | | Chrome Brown RO (SCrM) | 2 |

| | | | |
|--|----|---|----|
| Chrome Black B, T . . . | 1 | Maloon O | 3 |
| Chromogen I | 1 | Methyl Alkaline Blue MLB . . . | 5a |
| Chromotrope FB (SCr, SCrM) . . . | 2 | Methyl Violet, all brands . . . | 5a |
| Chromotrope 6B, 8B, 10B, F4B (SCr, SCrM), RR . . . | 3 | Milling Scarlet 4RO . . . | 6 |
| Chromotrope Blue A . . . | 3 | Mordant Yellow O (SCr, Cr V) | 3 |
| Chrysone G | 4 | Navy Blue V | 5b |
| Claret Red B, G, R . . . | 6 | Naphtalene Blue B, B extra, D | 3 |
| Cloth Red O | 6 | Naphtalene Blue DN . . . | 5a |
| Copper Blue B, B extra . . . | 3 | Naphtalene Green V . . . | 5b |
| Copper Black S, SB . . . | 3 | Naphthol Yellow S . . . | 3 |
| Cyanine B | 5b | Naphthol Red O . . . | 6 |
| Discharge Black WT . . . | 5b | New Cocchine O . . . | 4 |
| Eosine, all brands . . . | 1 | New Magenta O . . . | 4 |
| Erythrosine blueish . . . | 1 | Neutral Blue R, 3R . . . | 5a |
| Fast Blue, all brands . . . | 2 | Neutral Violet O . . . | 5a |
| Fast Dark Blue R . . . | 2 | Nigrosine No. 1, No. 3 . . . | 2 |
| Fast Yellow O | 6 | Opal Blue, blue shade . . . | 5b |
| Fast Red O, S | 6 | Opal Blue sup. sol. . . | 5b |
| Fast Acid Blue R . . . | 2 | Orange G | 4 |
| Fast Acid Eosine G . . . | 2 | Orange R, 2R, No. 2, No. 4 . . . | 6 |
| Fast Acid Magenta G . . . | 1 | Patent Blue, all brands . . . | 5b |
| Fast Acid Phloxine A . . . | 2 | Patent Green O, V, VS . . . | 5b |
| Fast Acid Red A . . . | 2 | Patent Marine Blue B, LE . . . | 4 |
| Fast Acid Violet; all brands | 2 | Phloxine, all brands . . . | 1 |
| Flavazine L, S | 4 | Purple Blue O | 5b |
| Flavazine T | 6 | Rosazeine, all brands . . . | 1 |
| Full Blue O | 5a | Rose Bengale B | 1 |
| Galleine A paste | 1 | Safranine O | 1 |
| Grenadine R | 3 | Scarlet 6R crystals . . . | 6 |
| Guensey Blue O | 5b | Scarlet B extra, 5R, 6R . . . | 4 |
| Indigo Substitute BS, WE . . . | 5b | Scarlet G, R, RR, 3R, 4R . . . | 6 |
| Indigo Carmine | 1 | Soluble blue, all brands . . . | 5b |
| Indigo | 2 | Vesuvine O | 4 |
| Magenta all brands . . . | 4 | Victoria Blue B, R, 4R . . . | 5a |
| Malachite Green powder superior B, BB, 4B . . . | 5a | Victoria Yellow conc. . . | 6 |
| Malachite Green crystals extra | 5b | Victoria Rubine O . . . | 6 |
| | | Victoria Scarlet, all brands . . . | 4 |
| | | Victoria Violet 4BS, 8BS . . . | 3 |
| | | Violet crystals O | 5a |

SILK DYEING.

a) SILK COLOURS CLASSIFIED ACCORDING TO THEIR METHOD OF DYEING:

The cleansing of the silk, preparatory to dyeing, consists of degumming and bleaching. The degumming serves to free the silk from the gum, thus making it pliable and lustrous. The bath is prepared with 25—30% of Olive Oil soap (referring to the weight of the material) and the silk treated in this liquor for 2 hours; the silk is only turned once, so that it remains for 1 hour in the liquid at each end. The temperature is 203° F. Care must be taken not to let the bath boil too violently, as the skeins might get entangled. For dark shades one soap bath is sufficient, whilst for lighter shades a second treatment in soap is resorted to, in order to produce a perfect white. The second soap bath contains 15% of soap and the silk remains in it for $\frac{3}{4}$ —1 hour. It is then well rinsed; it is advisable to add to the first rinsing liquid a small amount of soda. After rinsing, the silk is hydroextracted and stretched, because the silk threads are liable to contract in boiling. This stretching also enhances the lustre. One of the most important manipulations which the silk has afterwards to undergo, is the weighting. This operation is carried out either before or during dyeing. Two different kinds of weighting are to be distinguished:

1. Weighting with substances containing Tannin.
2. Weighting with mineral or Metal compounds.

For weighting silk with substances containing Tannin Sumach, Gall-nut extract, Tannin and Catechu etc. may serve. Generally the material is weighted during dyeing. Weighting before dyeing, with Gall-nut extract, is seldom resorted to, because a great part of the weighting would be lost during dyeing. The weighting during dyeing is carried out as follows. The silk is dyed rather fuller and brighter at first, and then the Tannin substance added to the hot dye-bath. The material is worked until the bath has cooled down to 85—105° F. After dyeing, the silk is well washed (cold or lukewarm) then slightly soaped, and finally lustred. If these soap baths are too concentrated, the weighting is partly stripped off the fibre. The lusturing bath may be employed for shading. For weighting and equalising the loss of weight through degumming (about 20—25%) generally 2 lbs. of Extract per 1 lb. of Silk are sufficient. Well decolourised Extract may be used for weighting the lightest shades, even creams. The Sumach baths are kept and used over again. Before starting with a new lot, a sample of the old bath is heated

and a small skein dyed in it, in order to see what shade is obtained, and then sufficient dyestuff and Extract are added to dye the silk up to shade. The concentration of the Sumach bath varies between 5—8° Tw.

Weighting with mineral or Metal compounds is generally carried out before dyeing, and mostly after degumming. The silk is carefully treated for $1\frac{1}{2}$ —2 hours in a Pink-salt bath of 48—52° Tw. and turned during this time about 5—7 times. After squeezing and washing well, it is treated at 104—113° F. with 2—2½% of Soda for $\frac{1}{2}$ an hour. The silk is then rinsed again, and if necessary, put back into the strengthened and neutralised weighting bath. Generally, two dips are required in order to bring the silk up to the original weight. After the Pink salt bath, it is necessary to soap the material. The addition of soap depends upon the number of turns in the Pink salt bath and may reach 100% of the weight of the silk. Before entering the material into this bath, it is advisable to pass it through a weak Soda or Ammonia bath and then put it through another soaping. A newer way of weighting after degumming is the so-called Phosphate Silicate method:

After degumming, the silk is put through a Pink salt bath 48—52° Tw. for $1\frac{1}{2}$ —2 hours, then well squeezed and carefully rinsed. Instead of the Soda bath, it is then treated with Phosphate of Soda of 6—8° Tw. for 1 hour at 158—176° F. After this the Waterglass (Silicate of Soda) bath is given at 6—8° Tw. for 1 hour at 158—176° F. After washing, follows the second treatment in the Pink Salt bath. This method yields an increased weighting. With 4 Pink dips, up to and above 100% may be reached.

THE BLEACHING OF SILK.

For light pure shades, the degumming of the silk is not sufficient, especially for material containing yellow gum; in this case the silk must be bleached. For this purpose Sulphurous acid is used. The silk is well squeezed after the second degumming and placed on sticks in the sulphur stove. In the lower part of the stove a vessel is placed which contains sulphur sticks; these are ignited by placing a red-hot iron rod into it. After this, the stove is quickly closed. The process lasts 12 hours. After washing, the material is then passed through a soap bath of 104—113° F. for $\frac{1}{4}$ — $\frac{1}{2}$ an hour.

This process is the oldest and most generally applied method. A recent process introduced for bleaching Silk is by means of Sodium Peroxide. The bleaching bath contains for 20 lbs. of silk, 50 gallons of water and 2½ lbs. of Sulphuric acid, 168° Tw., to this, very gradually, and whilst constantly stirring the liquid, 2 lbs. of Sodium Peroxide are added, and the liquid neutralised with Ammonia or Silicate of Soda until it shows a slight alkaline reaction. The silk is entered at 104° F. and turned for some time, then the bath is heated to 203° F. and the material left in this bath for 5—6 hours until satisfactorily bleached. (It is advisable to boil up the liquid from time to time.) The silk is then rinsed, soured with Sulphuric acid, rinsed again, soaped for $\frac{1}{2}$ an hour with 5—7½ parts of

Olive Oil soap per 1000 at the boil and rinsed again. These operations may have to be repeated.

The apparatus in which the bleaching operation is carried out ought to be made of wood, clay, lead or enamel.

According to the character of the dyestuffs, the silk is dyed by various methods. The most important ones are:

1. Dyeing in acidified boiled-off liquor.
2. Dyeing in a neutral soap bath.
3. Dyeing on previously mordanted material.
4. Dyeing with Primuline.
5. Dyeing with Thiogene Colours

1. Silk colours, dyeing in acidified boiled-off liquor.

The dyebath is prepared with the required amount of Sulphuric or Acetic acid, then the boiled off liquor (50—100 parts per 1000) is added and finally the colour solution poured into this bath. The silk is entered at 86—104° F. the temperature slowly raised to 203° F. and the dyeing operation carried on until the bath is nearly exhausted. After dyeing the material is rinsed and lustred in a weak acid bath.

Piece material is generally dyed in an acid bath without the addition of boiled-off liquor.

a) With Sulphuric acid.

| | |
|-----------------------------------|-------------------------------------|
| Acid Magenta, all brands, | Acid Alizarine Grey G, |
| Acid Maroon O, | Black Black O, |
| Acid Cerise O, | Fast Dark Blue R, |
| Orseille R, B, | New Yellow No. 1, No. 4, D spirit., |
| Acid Violet, all brands, | Silk Blue all brands, |
| Sulpho Rosazaine B, B extra, G, | Flavazine S, L, |
| " G extra, | New Yellow H, |
| Methyl Blue for Silk MLB, | Azo Yellow conc., |
| Methyl Blue for Cotton, | Azoflavine H, conc., |
| Opal Blue Superior, | Victoria Yellow conc., |
| Silk Blue, all brands, | Orange No. 4, G, No. 2, |
| Opal Blue blue shade, | Brilliant Orange O, G, R, |
| Bleu de Lyon O, R, spirit. | Fast Brown O, |
| Cotton Light Blue O, soluble, | Fast Brown yellowish, |
| conc., | Azo Brown V. |
| Cotton Blue R, | Scarlet, all brands, |
| Victoria Blue B, R, | Scarlet 6R crystals, |
| Acid Green, all brands, | Diamond Scarlet for Silk G, |
| Patent Blue A, V, superior, L, | Scarlet for Silk O, G, |
| Violamine G, R, A2R, B, 3B, | Brilliant Croceine, all brands, |
| Alizarine Direct Green G, | Fast Red O, S, |
| Alizarine Direct Blue B, E3B, EB, | Brilliant Crimson O, |
| Alizarine Direct Violet R, | Amaranth O, |
| Violamine G, R, A2R, B, 3B, | Victoria Rubine O, |
| Fast Blue, all brands, | Ciaret Red G, R, B, 3B, |
| Black Blue O, | |

| | |
|--|--|
| Amido Naphthol Black 4D, 4B extra, 6B, S, Silk Grey O, R fast to water, Chinoline Yellow O, | Naphthol Yellow S, Black for Tussah O. Ch. Janus Black I, D. |
|--|--|

b) With Acetic acid.

| | |
|---|--|
| Anamine, all brands, Phosphine new, Vesuvine conc., 3R superior, 4BG conc., extra yellow, Magenta, all brands, Maroon O, Cerise G, Grenadine O, Cardinal R. New Magenta O, Safranine, all brands, Malachite Green cryst. extra, Brilliant Green cryst extra, Methyl Violet, all brands, Violet Crystals O, Fluorescent Violet, all brands, Methylene Blue BB conc., R-6R, Methylene Green, all brands, Primula R. B, Methylene Violet 2RA, 2RN, BN, Rosolane, all brands, Victoria Blue B, R. Methylene Grey O, NFS, | Eosine extra spirit, Cyanosine O spirit, Eosine extra AG, BB, Erythrosine, yellow shade, blue shade, extra blue shade N, blue shade N, extra N, yellow shade N, Phloxine GA extra, BA extra, G, O, 2B, 5B, Rose Bengale G, B, Rosazeine O, B, extra, B extra, 4G, 4G extra, Violamine, all brands, Patent Blue A, V, N, G, L, superior. Janus Yellow G, R, Janus Red B, Janus Brown R, Dianil Yellow R, 2R, 3G, Aurophenine O, Dianil Orange G, N, Dianil Blue G, B, R, Dianil Brown 3GO, R, BD. |
|---|--|

2. Silk colours, dyeing in a neutral (or alkaline) soap bath.

The bath is prepared with Olive Oil Soap (10—12 parts per 1000) and the colour solution added. After having raised the temperature to the boil, the silk is dyed for $\frac{1}{2}$ — $\frac{3}{4}$ of an hour. (It is advisable to boil the bath up once more during this time.) Then the material is rinsed in water, which ought to be free from lime, and soured with Muratic or Sulphuric acid at 140—176° F.

Alkaline Blue, all brands,
Methyl Alkaline Blue MLD,
Alkaline Violet O.

3. Silk colours, dyeing on a mordant.

The silk is first boiled off, then washed at 86—104° F. with clean water and dried. It is then steeped for 12—24 hours in the mordant which consists of

Nitrate Mordant 15° Tw. or of
Chloride of Chrome S 33° Tw.

After mordanting, the silk is well washed in clean water (free from lime if possible) and then dyed. The dye-liquid consists of boiled off liquor diluted with an equal quantity of water. The Alizarine Colours are stirred into this bath (cold). The silk material is entered cold, then the temperature slowly raised to the boil and the dyeing operation carried out for about 2 hours; the temperature ought to remain for at least 1 hour at $194-210^{\circ}$ F.

After dyeing, the silk is well washed in water which ought to be free from lime, hydroextracted and then soaped in a neutral soap bath (5-7 parts of soap per 1000 parts of liquid) for $\frac{1}{2}$ an hour at the boil, then washed again and finally lustrated with Tartaric or Acetic acid. It is advisable to add to the last bath (lustring) some Olive oil, previously boiled with a little Soda. Boiled off liquor containing Tin (originating from material which was prepared with Tin solution) ought never to be used again.

The Nitrate mordant for light shades can be diluted to 3-7.4° Tw. Chrome Chloride ought not to be used for light shades. Care must be taken to get the silk wetted through with the mordant, before it is steeped over-night, for the places which have not been moistened sufficiently, will remain white in the subsequent dyeing process.

| | |
|------------------------------|---------------------------|
| Alizarine Yellow GG paste, R | Alizarine Brown paste, |
| Alizarine Orange paste, | Alizarine Blue DNX paste, |
| Alizarine Red, all brands, | Ceruleine paste A, |
| Alizarine Claret R paste, | Galleine paste A. |

4. Dyeing with Primuline.

The silk is dyed for 1 hour at the boil in a bath which is made acid with Acetic acid and contains 10% Primuline O.

It is then rinsed and diazotised for $\frac{1}{2}$ hour cold with:

3% Nitrite of Soda
5% Sulphuric acid 168 $\frac{1}{2}$ ° Tw.

Then rinsed again, and developed cold for $\frac{1}{2}$ hour with:

1.2% 3-Nitrophenol
1% Soda 168 $\frac{1}{2}$ ° Tw.,

rinsed again and soaped for $\frac{1}{2}$ an hour at the boil with 5 parts Olive oil soap per 1000 parts of water. Finally the material is lustrated with Acetic acid.

5. Dyeing of silk with Vat-Dyestuffs.

For specially fast shades on silk Vat-Dyestuffs are used. We may mention the following:

| | | |
|--------------------|------------------------|---------------------------|
| Indigo | MLB/2B, MLB/4B, | Helindone Red B, 3B, |
| | MLB/6B, MLB/8B, MLB/R, | Helindone Fast Scarlet R. |
| | MLB/RR | Helindone Orange R, |
| Helindone Blue 2B, | | Helindone Brown G. |

The colours can be combined with one another. The standard vats are set as stated in the chapter on cotton-dyeing. The vat is sharpened with 2.5 parts of Hydrosulphite powder per 10000 parts. The standard vat is then added. The goods are entered at 140° F., dyed for $\frac{1}{2}$ hour under the surface, wrung, aired for $\frac{1}{2}$ hour, well rinsed and soaped for $\frac{1}{2}$ hour with 15 parts of Olive Oil Soap per 1000 parts. If Helindone Red is cross-dyed with Alizarine, very bright reddish Blues are obtained.

b) SILK COLOURS CLASSIFIED ACCORDING TO SPECIFIC PROPERTIES:

1. Silk colours which equalise on tin-weighted material.

| | |
|---------------------------------|---------------------------------|
| Magenta, all brands, | Rose Bengale G, B, |
| New Magenta O, | Violamine, all brands, |
| Malachite Green cryst extra, | Alkaline Blue, all brands, |
| Brilliant Green cryst extra, | Methyl Alkaline Blue MLB, |
| Fluorescent Violet, all brands, | Patent Blue V, superior, L, A, |
| Methyl Violet B, 6B, R, 5R, | Fast Dark Blue R, |
| Primula R, B, | Chinoline Yellow O, |
| Violet crystals O, | Naphthol Yellow S, |
| Victoria Blue B, R, | Flavazine T, |
| Methylene Blue BB conc., R-6R, | Flavazine S, L, |
| Methylene Green, all brands, | Azo Yellow conc., |
| Safranine, all brands, | New Yellow H, |
| Methylene Violet 2RA, 2RN, BN, | Azoflavine H conc., |
| Rosolane, all brands, | Orange G, No. 2, |
| Coal Black O, I, II, | Brilliant Orange O, G, R, |
| Rosazene, all brands, | Diamond Scarlet for Silk G, |
| Eosine extra spirit, | Scarlet for Silk O, G, |
| Cyanosine O spirit, | Scarlet G, R-6R, B extra, for |
| Eosine extra AG, BB, | Silk, |
| Erythrosine yellow shade, blue | Fast Red O, |
| shade, extra blue shade N, | Brilliant Crimson O, |
| blue shade N, extra N, yellow | Amaranth O, |
| shade N, | Brilliant Croceine, all brands, |
| Phloxine GA extra, BA extra, | Acid Alizarine Grey G, |
| G, O, 2B, 5B, | Janus Black I, D. |

2. Silk colours which equalise on material weighted before or after dyeing with tannin substances.

| | |
|----------------------------------|--------------------------------|
| Auramine conc., | Victoria Blue B, R, |
| Phosphine new, | Safranine conc., |
| Vesuvine conc., 3R superior, 4BG | Rosolane, all brands, |
| conc., extra yellow, | Methylene Grey O, NFS, |
| Magenta, all brands, | Rosazene O, B, extra, B extra, |
| Maroon O, | 4G, 4G extra, |
| Cerise G, | Scarlet for Silk, B extra, |
| Grenadine O, | Primula R, B, |
| Cardinal R, | Violet Crystals O, |
| New Magenta O, | Methylene Blue BB conc., R-6R, |
| Methyl Violet B, 6B, R, 5R, | Scarlet for Silk G, O, |
| Fluorescent Violet, all brands, | Diamond Scarlet for Silk G, |
| Methylene Green, all brands, | Fast Red O. |
| Methylene Violet 2RA, 2RN, BN, | |

3. Silk colours which excel as regards equalising.

| | |
|----------------------|---------------------------------|
| Magenta, all brands, | Malachite Green crystals extra, |
| New Magenta O, | Brilliant Green crystals extra, |

| | |
|---------------------------------|---------------------------------|
| Methyl Violet B, 6B, R, 5R. | Coal Black O, I, II, |
| Fluorescent Violet, all brands, | Eosine extra spirit, |
| Primula R, B, | Cyanosine O spirit, |
| Violet Crystals O, | Eosine extra AG, BB, |
| Victoria Blue B, R, | Erythrosine yellow shade, blue |
| Methylene Blue BB conc., | shade, extra blue shade N, |
| R-6R, | blue shade N, extra N, |
| Methylene Green, all brands, | yellow shade N. |
| Safranine conc., | Phloxine, all brands, |
| Alkaline Blue R conc., 2B, 4B, | Rose Bengale G, B, |
| 6B, 20L, 4C, 7C, | Rosazene, all brands, |
| Methyl Alkaline Blue MLB, | Violamine, all brands. |
| Fast Dark Blue R, | Diamond Scarlet for Silk G, |
| Chinoline Yellow O, | Azoflavine H conc., |
| Naphthol Yellow S, | New Yellow H, |
| Flavazine S, L, T, | Scarlet for Silk O, G, |
| Azo Yellow conc., | Scarlet G, R-6R, B extra, for |
| Orange G, No. 2, | Silk, |
| Brilliant Orange O, G, R, | Brilliant Crimson O, |
| Methylene Violet 2RA, 2RN, | Amaranth O, |
| BN. | Brilliant Croceine, all brands, |
| Rosolane, all brands, | Acid Alizarine Grey G. |

4. Silk colours for shading off logwood black.

| | |
|----------------------------|--------------------------------|
| Auramine conc., | Methylene Green, all brands, |
| Magenta, all brands. | Thionine Blue GO. |
| New Magenta. O, | Alkaline Blue R conc., 2B, 4B, |
| Methyl Violet, all brands, | 6B, 20L, 4C, 7C, |
| Methylene Blue BB conc., | Methyl Alkali Blue MLB, |
| Silk Blue BA, | Alkaline Violet O. |

5. Silk colours for dyeing white.

| | |
|-------------------------------|----------------------|
| Methyl Violet, 2B chem. pure, | Bleu de Lyon spirit, |
| 6B chem. pure, | Blue No. I spirit. |
| Rosolane, all brands, | |

6. Silk colours which stand the degumming process.

| | |
|-------------------------------|------------------------------|
| Victoria Blue B, R, | Ceruleine paste A, |
| Primuline O, developed with | Galleine paste A, |
| Beta Naphthol, | L. F. 2 MI B MLB R, MI B RR. |
| Alizarine Yellow GG paste, R, | MLB, 2 : |
| paste (on Chrome), | Helindone Blue 2B, |
| Alizarine Orange paste, | Helindone Red B, 3B, |
| Alizarine Red, all brands, | Helindone Fast Scarlet R, |
| Alizarine Claret R paste, | Helindone Orange R, |
| Alizarine Brown paste, | Helindone Brown G, |
| Alizarine Blue DNX paste, | Helindone Grey BB. |

7. Silk colours which stand boiling in Water.

| | |
|----------------------------|----------------------------|
| Alizarine Yellow GG paste, | Alizarine Orange paste, |
| R paste, (on Chrome), | Alizarine Red, all brands, |

| | |
|---|---------------------------|
| Alizarine Claret R paste, | Indigo MLB,MLB/R,MLB/RR, |
| Alizarine Brown paste, | Helindone Blue 2B, |
| Alizarine Blue DNX paste, | Helindone Red B, 3B |
| Ceruleine paste A, | Helindone Fast Scarlet R, |
| Galleine paste A, | Helindone Orange R, |
| Primuline O, (developed with Beta Naphthol), | Helindone Brown G, |
| Acid Alizarine Grey G, | Helindone Grey BB. |

8. Silk colours which stand rain.

| | |
|--|---|
| Janus Yellow G, R, | Violamine, all brands, |
| Janus Red B, | Bleu de Lyon O spirit, R spirit, |
| Janus Brown R, | Primuline O, developed with Beta Naphthol, |
| Dianil Yellow R, 2R, 3G, | Acid Alizarine Grey G, |
| Dianil Blue R, B, G, | Indigo MLB,MLB/R,MLB/RR, |
| Alizarine Yellow GG paste, R paste (on Chrome), | MLB/2B, |
| Alizarine Orange paste, | Helindone Blue 2B, |
| Alizarine Red, all brands, | Helindone Red B, 3B, |
| Alizarine Claret R paste, | Helindone Fast Scarlet R, |
| Alizarine Brown paste, | Helindone Orange R, |
| Alizarine Blue DNX paste, | Helindone Brown G, |
| Ceruleine paste A, | Helindone Grey BB. |
| Galleine paste A, | |

Also all Basic Colours and Fast Red O, treated with Tannin.

9. Silk colours which stand soaping at 140° F.

| | |
|--|---------------------------|
| Primuline O, developed with Beta Naphthol, | Alizarine Brown paste, |
| Janus Yellow G, R, | Alizarine Blue DNX paste, |
| Janus Brown R, | Indigo MLB,MLB/R,MLB/RR, |
| Janus Red B, | MLB/2B, |
| Alizarine Yellow GG paste, R paste (on Chrome), | Helindone Blue 2B, |
| Alizarine Orange paste, | Helindone Red B, 3B, |
| Alizarine Red, all brands, | Helindone Fast Scarlet R, |
| Alizarine Claret R paste, | Helindone Orange R, |
| | Helindone Brown G, |
| | Helindone Grey BB. |

10. Silk colours which stand light well.

| | |
|-----------------------------------|----------------------------------|
| Rosazeine, all brands, | Bleu de Lyon O spirit, R spirit, |
| Violamine, all brands, | Acid Alizarine Grey G, |
| Patent Blue A, V, N, L, superior, | Silk Blue 99, KR, T conc., T, |
| Methyl Blue for Silk MLB, | green shade, |
| Scarlet G, R-6R, B extra, | Fast Dark Blue R, |
| M old, M new. for Silk, | Flavazine T, |
| Scarlet for Silk, G, O, | Flavazine S, L, |
| Diamond Scarlet for Silk G, | Azoflavine H conc., |
| Fast Red O, | Azo Yellow conc., |
| Opal Blue superior, | Orange G, Nr. 2, |
| Opal Blue, blue shade, | Brilliant Orange G, O, R, |

| | |
|---------------------------------|----------------------------|
| Brilliant Crimson O, | Galleine paste A, |
| Amaranth O, | Victoria Yellow conc., |
| Brilliant Croceine, all brands, | Indigo MLB, MLB/R, MLB/RR, |
| Alizarine Yellow GG paste, R | MLB/2B, |
| paste (on Chrome), | Helindone Blue 2B, |
| Alizarine Orange paste, | Helindone Red B, 3B, |
| Alizarine Red, all brands, | Helindone Fast Scarlet R, |
| Alizarine Claret R paste, | Helindone Orange R, |
| Alizarine Brown paste, | Helindone Brown G, |
| Alizarine Blue DNX paste, | Helindone Grey BB |
| Ceruleine paste A, | |

11. Silk colours which stand light well on tin weighted material.

| | |
|-----------------------------|---------------------------------|
| Violamine, all brands, | Scarlet G, R, 5R, B extra for |
| Fast Dark Blue R, | Silk, |
| Diaml Yellow R, 2R, | Fast Red O, |
| Orange G, No. 2, | Brilliant Crimson O, |
| Scarlet for Silk O, G, | Amaranth O, |
| Diamond Scarlet for Silk G, | Brilliant Croceine, all brands. |
| Acid Alizarine Grey G, | |

12. Silk colours fast to stoving.

| | |
|----------------------------------|---------------------------------|
| Rosolane, all brands, | Acid Alizarine Grey G, |
| Methyl Violet B, 6B, R, 5R, | Deep Black O, |
| Victoria Blue B, R, | Fast Dark Blue R, |
| Cyanine B, | Chinoline Yellow O, |
| Fast Blue G extra, O, | Naphthol Yellow S, |
| Black Blue O, | Flavazine T, |
| Janus Yellow G, R, | Flavazine S, L, |
| Janus Red B, | Azo Yellow conc, |
| Rosazeine, all brands, | New Yellow H, |
| Eosine extra AG, extra BB, extra | Azoflavine H conc., |
| spirit, | Orange G, No. 2, |
| Cyanosine O spirit, | Brilliant Orange O, G, R, |
| Phloxine GA extra, BA extra, | Scarlet G, R, 4R, |
| G, O, 2B, 5B, | Scarlet 6R crystals, |
| Erythrosine yellow shade, blue | Brilliant Croceine, all brands, |
| shade, extra blue shade N, | Brilliant Crimson O, |
| blue shade N, extra N, yellow | Scarlet for Silk O, G, |
| shade N, | Diamond Scarlet for Silk G, |
| Rose Bengale G, B, | Fast Dark Blue R, MLB/RR |
| Violamine, all brands, | MLB/2B, |
| Acid Violet 5BF, 3RA, | Helindone Blue 2B, |
| Alkaline Blue R conc, 2B, 4B, | Helindone Red B, 3B, |
| 6B, 2OL, 4C, 7C, | Helindone Fast Scarlet R, |
| Methyl Alkali Blue MLB, | Helindone Orange R, |
| Alkaline Violet O, | Helindone Brown G, |
| Patent Blue A, N, B, | Helindone Grey BB. |

13. Silk colours which stand topping in an acid bath.

All Vat Dyestuffs.

All Basic Colours after-treated with tannin.

Alizarine Yellow GG paste and R paste, only on Chrome mordant.

Primuline Red (Primuline O and Beta Naphthol) topped in an Acetic acid bath.

COTTON DYEING.

a) COTTON COLOURS CLASSIFIED ACCORDING TO METHOD OF DYEING.

According to the nature of the dyestuffs, the methods of dyeing are to be divided into several groups:

- I. Dyeing with Basic colours on a tannin mordant or dyeing direct (Janus colours) and aftertreating with Tannin and Tatar Emetic.
 - II. Dyeing with direct (Dianil-) colours in a neutral or alkaline bath with or without aftertreatment.
 - III. Dyeing with sulphur (Thiogene-) colours in a Sodium Sulphide bath.
 - IV. Vat-dyeing.
 - V. Dyeing on simple or compound metallic mordants with or without the addition of fatty acids.
 - VI. Dyeing with Resorcline and Acid colours in a concentrated salt bath.
 - VII. Dyeing by means of oxidation.
 - VIII. Dyeing by a process of condensation on the fibre.
 - IX. Production of insoluble Azo-colours on the fibre.
-

I. DYEING WITH BASIC COLOURS.

The following are the general rules for the application of Basic colours;

First Method.

The Basic colours are most generally dyed on a tannin mordant; the cotton is mordanted with Tannic acid or other substances containing tannin, fixed with Antimony salts, washed and dyed.

Cotton yarn is **mordanted** in a concentrated bath (containing the 10 fold amount of water) with 1—6% Tannin, according to the depth of the required shade; the yarn is entered at 194° F., worked without steam for $\frac{1}{2}$ an hour and then left in the bath, steeped for 6 to 12 hours, or preferably, over-night. After rinsing or hydroextracting, the yarn is entered into a fixing bath containing $\frac{1}{2}$ —3% Tatar Emetic and some Chalk, and worked for $\frac{1}{2}$ — $\frac{3}{4}$ of an hour at 65—75° F; then the yarn is rinsed, eventually slightly soaped and finally hydroextracted.

Old tannin baths can be used over again when replenished with about 70% of the amount of Tannin used for the first bath. In order to prevent decomposition, it is advisable to boil the baths repeatedly, or to add a little Carbolic acid.

In many instances, especially for dark shades, the Tannin can be replaced by cheaper products: 1 lb. Tannin equals about $1\frac{1}{2}$ —2 lbs. Gall nuts, or 4 lbs. Sumach extract (25%) or 5—6 lbs. Sumach leaves.

Instead of Tartar Emetic, other Antimony salts in equivalent proportions can be employed. 9 parts Antimony Salt of de Haën or 6.6 parts Patent Salt of R. Köpp & Co., are equal to 10 parts Tartar Emetic.

Piece goods are either mordanted and fixed on the jigger, or padded in the two-roller padding machine. In the latter case the padding liquids are made up with 2—50 parts Tannin and 1—25 parts Tartar Emetic per 1000 parts liquid.

Dyeing. The hydroextracted material is entered into a cold bath containing 1—5% Acetic acid or 2—10% Alum; it is well worked for some time and then the dyestuff solutions are added in several portions. After $\frac{1}{2}$ an hour the bath is slowly heated to 158° F. and the material dyed to pattern, whilst the temperature is gradually raised to the boil. Finally the cotton is rinsed, soaped, if need be, hydroextracted and dried.

In order to increase the fastness, the dyed yarn is occasionally worked again in the old Tannin and Tartar Emetic baths.

The following dyestuffs are suitable for Tannin-Antimony mordants:

Auramine conc., O, I, II,
Methylene Yellow H,
Flavophosphine G conc. new,
2G conc. new, 4G conc. new,
R conc. new,
Azophosphine GO, BRO,
Chrysoidine A cryst., C cryst.,
C extra crystals.
Vesuvine, all brands,
Cutch Brown D, G,
Dark Brown M, MB,
Magenta, all brands,
Cerise G, R,
Methylene Heliotrope O,
Grenadine O, R, RR,
Maroon O, extra,
Cardinal R, G,
New Magenta O, P,
Safranine, all brands,
Rosolane O, T,
Cotton Scarlet O,
Rosazeine, all brands,
Rosazeine Scarlet G, G extra,
Methylene Violet, all brands,
Methyl Violet, all brands,
Violet Crystals O,
Ethyl Blue, all brands,

Victoria Blue B, R, 4R,
Methylene Blue, all brands,
Methylene Indigo O, SS,
Thionine Blue GO,
Magenta Dark Blue, all brands,
Cotton Blue, all brands,
Conc. Cotton Blue, all brands,
Pure Blue, all brands,
Cotton Light Blue O, soluble,
Methyl Blue for Cotton MLB,
China Blue, all brands,
Fast Blue for Cotton, all brands,
New Ethyl Blue RS, BS,
Indophene Blue, all brands,
Methylene Grey, all brands,
Silk Grey O fast to water,
Malachite Green, all brands,
Brilliant Green, all brands,
Methylene Green, all brands,
Janus Green B, G,
Janus Yellow R, G,
Janus Red B,
Janus Brown BB, R,
Janus Blue G, B, R,
Janus Dark Blue R, B,
Janus Black O, I, II, D,
Janus Grey B, BB.

Second Method.

To obtain darker and duller shades, a Tannin-Iron mordant is employed. The Cotton is treated with a solution of Tannin or Sumach, worked for $\frac{1}{4}$ hour in a cold bath of Pyrolignite of Iron of about 3–5° Tw., thoroughly rinsed, and dyed in the manner described above.

In some cases the cotton is dyed according to the first method and afterwards treated with Iron salts.

Third Method.

The Basic colours may also be dyed on a Tin or Tannin-Tin mordant. The application is as follows:

The well boiled and bleached cotton is entered into a cold bath containing 0.1–1% Tin crystals and a small amount of Muriatic acid, to keep the bath clear. The material is worked for $\frac{1}{2}$ an hour, lifted, rinsed and dyed cold with an addition of 1–2% Acetic acid to the dyebath then rinsed and dried immediately. For deeper shades the material is at first mordanted with 2–3% Tannin and then with Tin mordant as stated above. For full shades 2–3% Alum in addition to the Acetic acid are added to the bath and the temperature is raised to about 104° F. Methylene Blue, Malachite Green, Methyl Violet etc. may be employed for shading off in the same bath.

The following colours are especially suitable for this method:

| | |
|---------------------------------|-----------------------------|
| Conc. Cotton Blue RR, R, No. 1, | Cotton Blue extra, OO, |
| No. 2, No. 2 double, | Methyl Blue for Cotton MLB, |
| Cotton Light Blue O soluble, | China Blue No. 1. No. 2. |

Fourth Method.

(Patented process.)

The cold bath is prepared with 5–6% Acetic acid, then 1–2% Tannin and finally the necessary amounts of dyestuff (up to 1%) are added. The cotton is entered and worked for $\frac{1}{4}$ of an hour cold, then for $\frac{1}{4}$ of an hour at 104° F., and for another $\frac{1}{4}$ of an hour at 140° F. Then it is lifted, rinsed, wrung out and dried. The fastness is increased if the yarn is wrung after dyeing, and treated in the first rinsing bath with $\frac{1}{2}$ –1% Tartar Emetic. After giving some turns in this bath the yarn is rinsed a second time. The results may be shaded in the Tartar Emetic bath:

| | |
|-----------------------------------|-----------------------------|
| Auramine conc. O, I, II, | Cutch Brown D, G, |
| Methylene Yellow H, | Dark Brown M, MB, |
| Phosphine, all brands, | Magenta, all brands, |
| Brilliant Green, all brands, | Cerise, all brands, |
| Rosazeine, all brands, | Grenadine, all brands, |
| Rosazeine Scarlet G, G extra, | Maïoon O, extra, |
| Azophosphine GO, BRO, | Cardinal R, G, |
| Chrysoidine A. cryst., C. cryst., | New Magenta O, |
| C extra cryst., R, | Safranine GGS, AN extra, O, |
| Vesuvine, all brands, | conc., conc. B, |

| | |
|-------------------------------|-------------------------------|
| Methylene Violet, all brands, | Fast Cotton Blue, all brands. |
| Methylene Heliotrope O, | Fast New Blue 3R crystals, |
| Rosolane, all brands, | Indamine Blue, all brands, |
| Scarlet for Cotton O, | Ethyl Blue BF, BD, RD, |
| Methyl Violet, all brands, | Indophene Blue B, G, 2B, |
| Violet Crystals O, | Methylene Grey, all brands, |
| Victoria Blue B, | Janus Blue G, B, R, |
| Malachite Green, all brands, | Janus Dark Blue R, B, |
| Methylene Green, all brands, | Janus Green B, G, |
| Methylene Indigo O, SS. | Janus Black O, I, II, D, |
| Thionine Blue GO, | Janus Grey B, BB, |
| Methylene Blue, all brands, | Janus Brown B, R, |
| Janus Blue, all brands, | Janus Red B, |
| Methylene Dark Blue RBN, 3BN, | Janus Yellow R, G. |

Fifth Method.

A number of Basic colours, such as the Rosazeines, Auramines and Safranines can be dyed on an oil mordant. The shades are not as fast to light and washing, but show a great brilliancy of colour. The material is saturated with a solution of 100 parts Turkey Red oil per 1000 parts of water and dried for 12 hours at 122° F. It is advisable to carry out this procedure twice. Then the cotton is dyed with the necessary amounts of dyestuff (cold to 122° F.) eventually slightly rinsed, or dried directly after dyeing.

DYEING WITH JANUS COLOURS.

The Janus colours occupy an intermediate position between Basic and direct dyeing colours. They are Azo colours of strongly Basic character and possess an extraordinary affinity for both animal and vegetable fibres. They are readily and evenly taken up by the animal and vegetable fibre (Victoria Blue B has the same qualities) and aftertreated with Tannin and Antimony.

There are two methods of application:

First Method.

I. Dyeing: The dyebath is acidified with a little Acetic acid, then 5% Sulphate of Zinc and a portion of the dyestuff solution are added. The previously boiled (cotton) material is entered at about 194° F., a few turns are given and then the remainder of the dyestuff solutions is added in several portions. After ½ an hour, 20% Common salt or calc. Glauber's salt are added, and the material worked for ½ an hour near the boil, then the steam turned off and the goods left in the bath for another ½ hour. Finally the material is rinsed, then wrung or hydroextracted.

II. Fixing: The dyed cotton is taken into a cold bath containing 2–6% Tannin or the equivalent amount of Sumach leaves or Sumach extract. After working cold for ¼ of an hour, it is lifted, 1–3% Tartar Emetic and 1.5% conc. Sulphuric acid are added to the bath; then the material is re-entered and worked cold for ¼ of an hour, then for ¼ of an hour at 122° F., and for another ¼ of an hour at about 170–212° F. Finally the material is thoroughly rinsed.

Second Method.

I. The dyeing process remains the same as described in the first method.

II. Fixing. 1st Bath: The dyed, rinsed and hydroextracted material is worked for $\frac{1}{4}$ of an hour at 122° F., in a concentrated bath containing 2–6% Tannin or the equivalent amount of other tannin products, and then left steeped for several hours or overnight in the bath. It is then wrung or hydroextracted.

2nd Bath: The tannated material is worked for $\frac{1}{2}$ — $\frac{3}{4}$ of an hour in a cold fresh bath containing 1–3% Tartar Emetic, then well rinsed, soaped if necessary and dried.

The following colours are applied by these methods:

| | |
|--------------------|--------------------------|
| Janus Yellow G, R, | Janus Blue G, R, B, |
| Janus Red B, | Janus Dark Blue B, R, |
| Janus Brown B, R, | Janus Black O, I, II, D, |
| Janus Grey B, BB, | Victoria Blue B. |
| Janus Green G, B, | |

These colours may be shaded off with small amounts of:

| | |
|------------------------------|-------------------------------|
| Methylene Blue, all brands, | Methylene Violet, all brands, |
| Malachite Green, all brands, | Methylene Heliotrope O, |
| Brilliant Green, all brands, | Rosolane, all brands. |
| Safranine, all brands, | |

The Janus colours also dye unmoiranted cotton direct, even in deep shades, in a slightly acid bath i. e. with the addition of an acid salt (such as Alum, Acetate of Zinc, Fluoride of Chrome) or of diluted acid. These colours are:

| | |
|--------------------------|-----------------------------|
| Janus Yellow G, R, | Janus Dark Blue B, R, |
| Janus Red B, | Janus Blue B, G, R, |
| Janus Brown B, R, | Methylene Grey, all brands, |
| Janus Black O, I, II, D, | Indamine Blue N extra, |
| Janus Green G, B, | Victoria Blue B, |
| Janus Grey B, BB, | Safranine in light shades. |

Finally the Janus colours are especially adapted for dyeing **artificial silk**, as the shades so produced are fast to water.

II. DYEING WITH DIRECT (DIANIL) COLOURS.

A. Direct dyeing.

According to the colours used, the dyeing is carried out in:

1. a neutral,
2. a weakly alkaline or,
3. an alkaline bath.

When mixing the dyestuffs of various groups, the method of dyeing follows that of the predominant component. However, the

Dianil Blues G, 2G, B, R, 2R, 3R, 4R, E, ET, BX, 2RS are always dyed without the addition of Soda, but brands H6G, H3G, H2G and HG withstand the action of a weak alkali in the dyebaths.

Cresotine Yellow G is either dyed in a neutral bath or preferably with the addition of 10% Sodium Phosphate and 2% Soap.

1.

Dyeing in a neutral Bath.

The bath is prepared for light shades (1% dyestuff) with 1–10% Common salt or calc. Glauber's salt, for medium shades (1–2% dyestuff) with 10–15% Common salt, and for dark shades (2–4% dyestuff or more) with 15–25% Common salt. Light shades are dyed at 86–140° F., medium or dark shades are dyed at the boil for 1 hour.

| | |
|------------------------------|-------------------------------|
| Dianil Yellow G, 3G, R, 2R, | 3R, 4R, E, ET, BX, 2RS, |
| Dianil Pure Yellow HS, | H6G, H3G, H2G, HG, |
| Dianil Direct Yellow S, | Dianil Brilliant Blue 5G, 3G, |
| Aurophenine conc., O, I, II, | Dianil Brilliant Green G, |
| Oxydianil Yellow O, G, | Dianil Azurine G, GA, |
| Primuline O, F, | Dianil Dark Blue 3R, |
| Dianil Brown R, BD, | Patent Dianil Black FF conc., |
| Dianil Green G, B, BD, | FFC conc., EB conc., EF |
| Dianil Dark Green B, | conc., FB, RW extra, EW |
| Dianil Blue G, 2G, B, R, 2R, | extra, EBV conc. |

2.

When dyeing in a weakly Alkaline Bath, the dye-bath is prepared as described above (under Nr. I), with the addition of $\frac{1}{2}$ –2% Soda:

| | |
|-----------------------------|----------------------------------|
| Oxydianil Yellow O, G, | Diazanil Scarlet G, B, 6B, |
| Dianil Chrome Brown G, R, | Dianil Brown 5G, 3GO, 2G, |
| Primuline O, F, | G, R, 3R, M, BD, B, D, |
| Dianil Orange G, N, | X, MH, MF, |
| Toluylene Orange R, | Dianil Fast Brown GR, 2G, |
| Dianil Fast Orange O, RR, | 3R, B, |
| Dianil Scarlet G, 2R, | Dianil Copper Brown O, |
| Dianil Crimson B, G, | Dianil Japonine G, |
| Dianil Fast Red PH, | Dianil Blue H6G, H3G, H2G, |
| Dianil Red R, 4B, 6B, 10B, | HG, |
| Dianil Claret Red B, G, | Dianil Indigo O, |
| Dianil Magenta O, | Dianil Dark Blue 3R, R, |
| Dianil Violet H, | Dianil Azurine 3R, 3G, G, GA, |
| Brilliant Dianil Red R, | Dianil Fast Olive 2G, |
| Delta Purpurine 5B, | Dianil Black G, R, CB, HW, |
| Dianil Pink BD, | ES, N, CR, PR, |
| Dianil Fast Scarlet GS, RS, | Patent Dianil Black, all brands, |
| RS extra, 4BS, 6BS, 8BS, | Diazanil Black B, D, |
| 4BL, | |

3.

Dyeing in an acid Bath.

Dianil Brilliant Blue 3G, 6G.

Dianil Brilliant Green G

are best dyed with only a slight addition of acetic acid, but may also be combined with other dyestuffs in a neutral bath.

The following dyestuffs may be dyed without Salt; it is sufficient to add $\frac{1}{2}$ —5% Soda or 2% Soda and 5% Soap.

| | |
|----------------------------------|--------------------------------|
| Dianil Red R, 4B, 6B, 10B, | Dianil Fast Scarlet GS, RS, RS |
| Brilliant Dianil Red R, R conc., | extra, 4BS, 6BS, 8 BS, |
| Delta Purpurine 5B, | Dianil Black PR. |

When dyeing mercerised material it is advisable to add to the bath, for light shades 2% Turkey Red oil and $2\frac{1}{2}$ % Sodium Phosphate, for medium and dark shades $1\frac{1}{2}$ parts Turkey Red oil and 10—15 parts Glauber's salt crystals per 1000, by which means more even results are obtained.

B. After-Treatments.

The fastness properties of a number of Dianil colours and likewise of some other colours, are increased by an after-treatment with Metal salts, oxidising agents etc.

These methods are:

1. After-treatment with Copper Sulphate.
2. Bichrome after-treatment.
3. Chrome & Copper after-treatment.
4. Chloride of Lime after-treatment.
5. Azophor Red after-treatment.
6. Solidogen after-treatment.
7. Diazotising and developing.

1.

A **Copper Sulphate** after-treatment when applied to the following colours is of beneficial influence as regards fastness to light:

| | |
|---------------------------|-------------------------------|
| Dianil Yellow R, 2R, 3G, | Dianil Claret Red G and B can |
| Cresotine Yellow G. | be used for shading. |
| Dianil Brown 5G, 3GO, 2G, | Dianil Dark Blue R, 3R, |
| 3R, MH. | Dianil Fast Brown B, |
| Dianil Japonine G, | Dianil Copper Brown O, |
| Dianil Azurine G, GA, | Dianil Black G, R, N, CB, CR, |
| Dianil Indigo O, | HW. |

The dyed and rinsed material is treated in a fresh bath containing 3—5% Copper Sulphate and $1\frac{1}{2}$ —2% Acetic acid at 140—212° F., for half an hour, and then rinsed. The Copper Sulphate bath may contain some Basic colours for shading purposes; in this case the temperature is gradually raised, after working cold for $\frac{1}{4}$ of an hour.

2.

A **chrome-aftertreatment** affects the fastness to washing beneficially. The dyed and rinsed material is worked at 140 to 212° F. for half an hour in a bath containing:

3—4% Fluoride of Chrome 32° Tw.

3—4 Fluoride of Chrome and $1\frac{1}{2}$ % Acetic acid or

4—5% Chrome Alum

and finally rinsed.

The following dyestuffs are suitable for this aftertreatment:

| | |
|----------------------------------|-------------------------------|
| Dianil Yellow 3G, | Dianil Copper Brown O. |
| Cresotine Yellow G, | Dianil Japonine G, |
| Dianil Fast Orange G, RR, | Dianil Dark Green B, |
| Dianil Fast Red PH, | Dianil Fast Olive 2G, |
| Dianil Green G, | Dianil Dark Blue R, 3R, |
| Dianil Brown 5G, 3GO, 2G, | Dianil Black G, R, N, CB, CR. |
| Dianil Fast Brown B, GG, GR, 3R, | |

The following colours are not noticeably changed when after-treated with Chloride of Chrome, Chrome Alum, or Fluoride of Chrome, and are therefore suitable for shading:

| | |
|-------------------------|---------------------------|
| Dianil Yellow R, 2R, | Dianil Orange G, N, |
| Dianil Direct Yellow S, | Dianil Brown G, R, 3R, M, |
| Dianil Pure Yellow HS, | BD, B, D, MH. |
| Oxydianil Yellow O, G, | |

3.

A **chrome and copper after-treatment** affects the fastness to light and washing beneficially.

The dyed and rinsed material is worked in a fresh bath containing

$1\frac{1}{2}$ —3% Bichrome

2—3% Copper Sulphate and

2—3% Acetic acid

at 140—212° F. for $\frac{1}{2}$ an hour and then rinsed.

This aftertreatment may be applied to the following colours:

| | |
|----------------------------|------------------------------|
| Dianil Yellow 3 G, | Dianil Japonine G, |
| Cresotine Yellow G, | Dianil Fast Brown B, 2G, GR, |
| Dianil Fast Orange O, R, | 3R, |
| Dianil Chrome Brown G, | Dianil Fast Olive, GG, |
| Dianil Brown 3GO, 2 G, MH, | Dianil Black G, R, N, CB, CR |

When developed with Bichrome, Copper Sulphate and Sulphuric acid, the following colours produce exceptionally fast shades:

| | |
|-----------------------|---|
| Cresotine Yellow G, | Dianil Yellow 3G, (up to 1% for shading off). |
| Dianil Brown 3GO, MH, | |
| Dianil Fast Brown B, | Dianil Black R, N, CR. |
| Dianil Japonine G, | |

The dyed material is worked in a bath containing:

2% Bichrome,
2% Copper Sulphate and
2% Sulphuric acid 168 $\frac{1}{2}$ ° Tw.

for $\frac{1}{2}$ an hour at 195–212° F., then thoroughly rinsed and soaped if required.

4.

Primuline-Chloride of Lime-Yellow is produced by a process of oxidation, by means of Chloride of Lime on cotton dyed with Primuline.

The goods are dyed in the usual manner with Primuline O, rinsed, and then treated for $\frac{1}{4}$ hr in a bath (77° F.) containing per 100 gallons, $\frac{1}{2}$ a gallon of Chloride of Lime solution of 15° Tw. Afterwards the yarn is well rinsed.

A higher temperature of the Chloride of Lime bath produces redder shades.

Primuline-Chloride of Lime-Yellow is distinguished for extraordinary fastness.

5.

An after-treatment with **Azophor Red** has a beneficial effect upon the depth of the shade and fastness to washing.

After rinsing, the dyed material is worked for $\frac{1}{2}$ an hour in a cold bath containing 2–4% Azophor Red and 1–2% Acetate of Soda, then the material is rinsed again and soaped if necessary.

When dyeing to pattern, the slight change of shade due to this aftertreatment must be taken into consideration. Small differences are easily rectified with such colours as are not affected by Azophor Red.

Paranitraniline is applied in a similar manner.

The following colours may be aftertreated with Azophor Red.

| | |
|-----------------------------|-------------------------------|
| Primuline O, F, | Dianil Japonine G, |
| Dianil Orange N, | Dianil Dark Blue R, 3R, |
| Toluylene Orange R, | Dianil Black G, R, N, CB, PR, |
| Dianil Brown 3GO, 2G, G, R, | CR, HW. |
| 3R, M, BD, B, D, X, | |

The following colours which are only slightly changed when treated with Azophor Red PN, are suitable for shading the colours given above:

| | |
|--------------------------|--------------------------|
| Dianil Yellow R, RR, 3G, | Dianil Green G, |
| Dianil Direct Yellow S, | Dianil Blue, all brands, |
| Aurophenine O, I, | Dianil Claret Red G, B, |
| Oxydianil Yellow O, G, | Dianil Magenta O, |
| Dianil Orange G, | Dianil Fast Brown B, R. |

6.

An after-treatment with **Solidogen** improves the fastness to acids and to washing.

The bath is prepared with 2% Hydrochloric acid and then 2–6% Solidogen A are added. The dyed and well rinsed goods are worked for $\frac{1}{2}$ an hour at the boil and then well rinsed.

If copper vessels are used for dyeing, 1—2 ozs. Sulphocyanide of Ammonia are added per gallon of dyeliquid before adding the other ingredients.

The following dyestuffs are improved by an aftertreatment with Solidogen:

| | |
|-----------------------------|--|
| Dianil Orange G, | Dianil Blue G, B, R, 2R, 3R, |
| Dianil Scarlet G, 2R, | 4R, BX, |
| Dianil Red R, 4B, 6 B, 10B, | Dianil Black R, G, CB, CR, |
| Dianil Claret Red B, G, | Dianil Indigo O, |
| Brilliant Dianil Red R, | Dianil Dark Blue R, |
| Delta Purpurine 5B, | Primuline Red (Primuline O & Beta Naphthol). |

7.

The fastness of the shades can also be increased by **diazotising and developing** the colours.

The dyed goods are treated for $\frac{1}{2}$ an hour in a cold bath containing, according to depth of shade, 1.5—2.5% Nitrite of Soda and 5—7.5% Hydrochloric acid; they are then rinsed.

After diazotising, the goods must be protected against direct light, as they are affected by it at this stage.

The shades are developed in a fresh bath. This contains Phenols in alkaline solution, whilst bases are applicable in aqueous or slightly alkaline solutions. It is possible to mix Phenols and Diamines. The strength of the developing bath depends on the depth of the dyed shade and the character of the developer. The goods are worked cold for $\frac{1}{2}$ an hour and then rinsed.

In certain cases the shades are developed with Soda only. Dianil Black CR is in this way converted into a deep blue.

The following directions for preparing the developing bath will generally be applicable:

for light to medium shades:

0.3% Phenol, 0.9% Caustic Soda 36° Tw.,
 0.3% Resorcine, 1.2% Caustic Soda 36° Tw.,
 0.5% Beta Naphthol, 1% Caustic Soda 36° Tw.,
 0.5% Schaeffer's salt, 0.3% Soda calc.,
 0.35% Meta Phenylene Diamine,
 0.35% Meta Toluylene Diamine,
 0.5% Claret Developer, 0.1% Muriatic acid 36° Tw.

for medium to dark shades:

0.6% Phenol, 1.8% Caustic Soda 36° Tw.,
 0.6% Resorcine, 2.4% Caustic Soda 36° Tw.,
 1% Beta Naphthol, 2% Caustic Soda 36° Tw.,
 1% Schaeffer's salt, 0.6% Soda calc.,
 0.7% Meta Phenylene Diamine,
 0.7% Meta Toluylene Diamine,
 1% Claret Developer, 0.2% Muriatic acid 36° Tw.,

Colours suitable for diazotising and developing are:

| | |
|----------------------------|----------------------|
| Diazanil Scarlet G, B, 6B, | Dianil Azurine 3R, |
| Primuline O, F, | Dianil Black ES, |
| Dianil Brown MH, | Diazanil Black B, D, |
| Dianil Blue H6G, H3G, H2G, | |

The following colours do not change in the diazotising and developing, and are therefore suitable for shading the above mentioned colours:

| | |
|----------------------------|------------------------------|
| Dianil Yellow R, 2R, 3G, | Aurophenine O, I, |
| Dianil Direct Yellow S, | Dianil Claret Red G, B, |
| Dianil Orange G, | Dianil Blue G, B, R, 2R, 3R, |
| Dianil Red R, 4B, 6B, 10B, | 4R, BX, HG, |
| Oxydianil Yellow O, G, | Dianil Fast Brown B, |
| Dianil Pure Yellow HS, | |

III. DYEING WITH THIOTENE COLOURS.

Thiotene Colours (Sulphur Colours) are converted into a paste with hot water, in a wooden vessel, then the necessary amount of Sodium Sulphide is added and the whole boiled up with water. Finally, this solution is poured into the dyebath and salt added to it.

Copper and brass pipes and appliances must be exchanged for iron or leaden parts when working with Thiotene Colours.

Melanogen Blue B and BG, the forerunners of the Thiotene Colours, are dissolved without the addition of Sodium Sulphide at 176° F. with Soda only.

The dyebaths contain:

1. Thiotene dyestuff,
2. Sodium Sulphide,
3. Soda or Soda lye,
4. Common or Glauber's salt.

Small additions of Turkey Red Oil or Turkone Oil enhance the wetting and equalising. The proportions of dyestuff and Sodium Sulphide depend upon the depth of shade. Light shades require more Sodium Sulphide and less or no Salt. For dark shades the additions of Salt and Soda are so regulated that the liquid stands at 9° Tw. Below this concentration the colours do not exhaust sufficiently, and if on the other hand the baths show 14° Tw. or more, the colours are liable to bronze. For this reason it is advisable to ascertain the state of the concentration from time to time by means of the Hydrometer.

When dyeing in a mechanical apparatus, the Common salt is substituted by Glauber's salt, which is more soluble.

The dilution of the dyebaths has to be varied according to the various dyeing processes. The proportion of liquid to weight of material is:

- | | |
|---|------------|
| a) for yarns, dyed in an open cistern | 1:20 |
| b) for loose cotton in an open cistern | 1:20 |
| c) for pieces in a jigger | 1:5 |
| d) for material in a mechanical apparatus | 1:4 - 1:20 |

Although no definite instructions about the concentration of the dyebaths are possible, the following table — which refers to Thiogene Black conc. in particular — may serve as a guide in general.

| Dilution | Dyestuff | | | Sodium Sulphide cryst. | | | Soda calc. | | | Glauber's salt crystals. | | |
|----------|----------|------|------|------------------------|------|------|------------|------|------|--------------------------|------|------|
| | 1. | 2. | 3. | 1. | 2. | 3. | 1. | 2. | 3. | 1. | 2. | 3. |
| | Bath | Bath | Bath | Bath | Bath | Bath | Bath | Bath | Bath | Bath | Bath | Bath |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| 1:4 | 12 | 9,5 | 7 | 36 | 18 | 14 | 2,5 | 0,5 | 0,5 | — | — | — |
| 1:8 | 12 | 9,5 | 7 | 36 | 18 | 14 | 4 | 1 | 0,75 | 15 | — | — |
| 1:12 | 12 | 9,5 | 7 | 36 | 18 | 14 | 5 | 1,5 | 1 | 25 | 5 | — |
| 1:20 | 12 | 9,5 | 7 | 36 | 18 | 14 | 6 | 2 | 1,5 | 50 | 10 | 5 |

The Thiogene Colours are generally dyed just below the boil, especially in deep shades. The material is entered at the boil, the steam turned off, and the dyeing operation finished within 1 hour; during this period the baths are boiled up once or twice. When dyeing on the jigger the baths must be kept near to boiling point with indirect steam.

Comparative dye tests have shown, that for medium shades the results do not vary, whether the baths are boiled, or the temperature kept at 122° F. Even at 68° F. the shades do not differ much from those obtained at 122°. For this reason the Thiogene Colours may also be employed cold.

After dyeing, the material must be well and evenly squeezed and for this purpose generally iron rollers are used which are covered with india-rubber; for loose material the hydroextractor is employed.

The goods are rinsed in water until the latter runs off clear, then squeezed and finally dried.

Sometimes, however, a fatty substance is added to the last rinsing liquid in order to improve the shade. This so-called „softening process“ is carried out at 122—176° F. and soap, oil or fat, with or without Starch, are principally used for this purpose.

1% of Lard and 1% Starch deepens the black without altering its hue.

3% Soft soap makes the shade rather fuller and bluer.

3% Olive oil soap has a similar effect, although it is not quite so efficacious as soft soap.

Recently a new product, Korndorfer's Carbide oil, has been put on the market, which deepens the shade.

Sometimes Thiogene Colours are aftertreated in the following manner:

- with Alkaline salts,
- with Metal salts.
- developing with Steam and Air,
- developing by hanging or lying in a moist, and warm atmosphere,
- topping Blacks with Logwood.

a) Aftertreatment with alkaline salts: An aftertreatment with Alkalies or such salts as react alkaline (Ammonia, Soda, Borax, Acetate of Soda etc.) is resorted to if the dyed shades have come into contact with acids, viz. if half-wool goods with cotton warps have been dyed in an acid bath, or if the dyed goods have been treated with Metal salts etc.

b) Aftertreatment with metal salts: In order to improve still further the fastness of the Thiogene Colours to light and atmospheric influences, the shades are sometimes aftertreated with Chrome and Copper salts. This aftertreatment changes, in some instances, the original shade slightly and mostly favourably.

c) Developing with steam and air: This aftertreatment is applied to some of the Thiogene Blues. The material is exposed, after dyeing and squeezing, and before being rinsed, to steam intermixed with air in an ordinary steaming chest.

d) Developing by hanging or lying in a moist and warm atmosphere: This process is resorted to instead of steaming, for instance, for Thiogene Blue B.

e) On topping with logwood the shade becomes considerably deeper and richer: The rinsed material is taken into a bath containing 1-2% of Logwood extract and 1% Copper Sulphate at 104-122° F. and worked for about 20 minutes.

The Thiogene Black and Blue brands can be employed as a bottom for Indigo and Aniline Black.

The first rinsing liquids are mostly used for this purpose, and in this manner medium greys are obtained which, after one dip in a vat, yield blue shades equal in depth to Indigo blues of 3-4 dips.

Moreover, the Thiogene Colours can also be used as a bottom under Paranitraniline: this yields Claret, Grenade and dark Brown shades.

Small additions of Basic colours are fixed fairly firmly on Thiogene colours. By this means it becomes easy to shade the Thiogene Colours up to pattern. The goods are worked at ordinary temperature in a bath which is slightly acidified with Acetic acid, and the Basic dyestuffs are added to this gradually. If the water is free from lime, the colours may also be topped in a soap bath.

The tables show the amount of salt required when dyeing with the Thiogene Colours. The figures refer to the 20 fold amount of liquid, which is generally sufficient for dyeing yarn in a cistern.

Furthermore, the tables show the additions required for new and old baths, and to what degree the Thiogene Colours exhaust at different temperatures.

METHOD OF DYEING WITH THIOPENE COLOURS.

(Proportion of goods to dye liquid 1:20.)

| Colour | °/o Colour | | | °/o Sodium Sulphide cryst. | | | °/o Soda calc. | | | °/o Common salt | | |
|----------------------------------|------------|----|-----|----------------------------|------|------|----------------|----|-----|-----------------|----|-----|
| | I | II | III | I | II | III | I | II | III | I | II | III |
| Thiopene Black M conc. . . . | 10 | 8 | 6 | 30 | 16 | 12 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black BRR conc. . . . | 10 | 8 | 6 | 30 | 16 | 12 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black BB conc. . . . | 11 | 9 | 7 | 33 | 18 | 14 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Diamond Black V . . . | 15 | 12 | 9 | 30 | 18 | 13.5 | 10 | 3 | 1 | 20 | 4 | 2 |
| Thiopene Diamond Black B . . . | 20 | 16 | 12 | 30 | 16 | 12 | 10 | 3 | 1 | 40 | 16 | 3 |
| Thiopene Black 4B conc. . . . | 10 | 8 | 6 | 30 | 16 | 12 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black 5B conc. . . . | 15 | 12 | 9 | 30 | 18 | 13.5 | 10 | 3 | 2 | 50 | 10 | 3 |
| Thiopene Coal Black O conc. . . | 10 | 8 | 6 | 30 | 16 | 12 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black MM conc. . . . | 10 | 8 | 6 | 30 | 16 | 12 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black MA extra strong | 7.5 | 6 | 4.8 | 22 | 12 | 9.6 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black MB extra strong | 7.5 | 6 | 4.8 | 22 | 12 | 9.6 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black MC extra strong | 7.5 | 6 | 4.8 | 22 | 12 | 9.6 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black MD extra strong | 7.5 | 6 | 4.8 | 22 | 12 | 9.6 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black ME extra strong | 7.5 | 6 | 4.8 | 22 | 12 | 9.6 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black MF extra strong | 12.5 | 10 | 7.5 | 10 | 5.5 | 4 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black M liquid | 20 | 16 | 12 | 10 | 5.5 | 4 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Padding Black M liquid | 22 | 16 | 13 | 10 | 5.5 | 4.25 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black BRR liquid . . . | 20 | 16 | 12 | 10 | 5.5 | 4 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black BB liquid | 20 | 16 | 12 | 10 | 5.5 | 4 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black 4B liquid | 25 | 20 | 15 | 12.5 | 7 | 5 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black 6BV liquid . . . | 25 | 20 | 15 | 12.5 | 7 | 5 | 10 | 3 | 1 | 50 | 10 | 3 |
| Thiopene Black NA | 20 | 16 | 12 | 30 | 16 | 12 | 10 | 3 | 1 | 50 | 10 | 3 |
| Melanogene T | 20 | 16 | 12 | — | — | — | 5 | 2 | 2 | 50 | 15 | 3 |
| Melanogene G | 20 | 16 | 12 | — | — | — | 5 | 2 | 2 | 50 | 15 | 3 |
| Thiopene Cyanine G | 10 | 6 | 4 | 15 | 6 | 4 | 5 | 2 | 2 | 30 | 6 | 3 |
| Thiopene Cyanine O | 10 | 6 | 4 | 15 | 6 | 4 | 5 | 2 | 2 | 30 | 6 | 3 |
| Thiopene New Blue JL | 10 | 7 | 5 | 10 | 7 | 5 | 5 | 2 | 2 | 30 | 6 | 3 |
| Thiopene New Blue BL | 10 | 7 | 5 | 10 | 7 | 5 | 5 | 2 | 2 | 30 | 6 | 3 |
| *Thiopene Blue B | 10 | 6 | 4 | 15 | 6 | 4 | 5 | 2 | 2 | 30 | 6 | 3 |
| **Thiopene Blue R | 10 | 6 | 4 | 20 | 6 | 4 | 5 | 2 | 2 | 30 | 6 | 3 |
| **Thiopene Blue RR | 10 | 6 | 5 | 20 | 6 | 4 | 5 | 2 | 2 | 30 | 6 | 3 |
| *Thiopene Dark Blue BL | 10 | 7 | 4 | 15 | 7 | 5 | 5 | 2 | 2 | 30 | 6 | 3 |
| *Thiopene Dark Blue BTL | 10 | 7 | 5 | 15 | 7 | 5 | 5 | 2 | 2 | 30 | 6 | 3 |
| Thiopene Navy Blue R conc. . . | 10 | 7 | 5 | 20 | 11.5 | 7.5 | 5 | 2 | 1 | 30 | 6 | 3 |
| Thiopene Violet V | 20 | 18 | 16 | 10 | 9 | 8 | — | — | — | — | — | — |
| Thiopene Violet B | 20 | 18 | 16 | 10 | 9 | 8 | — | — | — | — | — | — |
| Thiopene Heliotrope O | 20 | 18 | 16 | 10 | 9 | 8 | — | — | — | — | — | — |
| Thiopene Rubine O | 10 | 9 | 8 | 5 | 4 | 3 | — | — | — | — | — | — |
| Thiopene Dark Red R | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 3 | 1 | 30 | 6 | 3 |

* With an addition of 2.5% Soda-lye 77° Tw. to the first bath.

** With an addition of 10% Glucose to the first bath.

| Colour | % Colour | | | % Sodium Sulphide cryst. | | | % Soda calc. | | | % Common salt | | |
|---|-------------|----|-----|-----------------------------------|----|-----|--------------------|----|-----|---------------------|----|-----|
| | I | II | III | I | II | III | I | II | III | I | II | III |
| Thiogene Dark Red G | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 3 | 1 | 30 | 6 | 3 |
| Melanogene Blue B | 10 | 8 | 6 | — | — | — | 5 | 2 | 1 | 50 | 20 | 5 |
| Melanogene Blue BG | 10 | 8 | 6 | — | — | — | 5 | 2 | 1 | 50 | 20 | 5 |
| Thiogene Green B | 10 | 8 | 7.5 | 15 | 8 | 7.5 | 5 | 3 | 1 | 30 | 6 | 3 |
| Thiogene Green GG | 10 | 8 | 7.5 | 20 | 12 | 11 | 5 | 3 | 1 | 30 | 6 | 3 |
| Thiogene Green G | 10 | 8 | 6.6 | 20 | 16 | 12 | 5 | 3 | 1 | 30 | 6 | 3 |
| Thiogene Green BL extra . . . | 15 | 12 | 9 | 10 | 8 | 6 | 5 | 3 | 1 | 30 | 6 | 3 |
| Thiogene Green GL extra . . . | 15 | 12 | 9 | 15 | 12 | 9 | 5 | 3 | 1 | 30 | 6 | 3 |
| Thiogene Bronze G | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Olive Green GG . . . | 10 | 8 | 6 | 20 | 12 | 9 | 5 | 2 | 1 | 30 | 6 | 3 |
| Thiogene Olive Green GGN . . | 10 | 8 | 6 | 10 | 12 | 9 | 5 | 2 | 1 | 30 | 6 | 3 |
| Thiogene Olive Green G . . . | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Olive Green B . . . | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Golden Yellow AO . . | 10 | 8 | 6 | 16 | 12 | 9 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Yellow GG | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Yellow G | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Orange OG | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Orange RG | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Orange R | 10 | 8 | 6 | 20 | 16 | 12 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Orange RR | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Brown yellow shade OG conc. | 5 | 4 | 3 | 15 | 12 | 9 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Brown GC | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Brown GR | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Brown GRR | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Brown R | 10 | 8 | 6 | 5 | 4 | 3 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Catechu R | 10 | 8 | 6 | 15 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Brown S | 10 | 8 | 6 | 10 | 8 | 6 | 5 | 2 | 1 | 40 | 8 | 3 |
| Thiogene Khaki N conc. . . . | 5 | 4 | 3 | 20 | 16 | 12 | 5 | 2 | 1 | 40 | 8 | 3 |

EXHAUST TESTS OF THIOPENE COLOURS AT DIFFERENT TEMPERATURES.

I: baths are exhausted fairly well.
 II: results stand between I and III.
 III: baths exhaust badly.

| Colour | dye at 68° F. | dye at 122° F. | dye at the boil. |
|-----------------------------------|---------------------|----------------------|------------------------|
| Thiopenes Black M conc. . . . | III | II | I |
| Thiopenes Black BRR conc. . . . | III | II | I |
| Thiopenes Black BB conc. . . . | III | II | I |
| Thiopenes Diamond Black V . . . | III | II | I |
| Thiopenes Diamond Black B . . . | III | II | I |
| Thiopenes Black 4B conc. . . . | III | II | I |
| Thiopenes Black MM conc. . . . | III | II | I |
| Thiopenes Black MA extra strong | III | II | I |
| Thiopenes Black MM extra strong | III | II | I |
| Thiopenes Black BB extra strong . | III | II | I |
| Thiopenes Black BRR extra strong | III | II | I |
| Thiopenes Black M conc. . . . | III | II | I |
| Thiopenes Black M liquid | III | II | I |
| Thiopenes Padding Black M liquid | III | II | I |
| Thiopenes Black BRR liquid . . . | III | II | I |
| Thiopenes Black B3R liquid . . . | III | II | I |
| Thiopenes Black BB liquid | III | II | I |
| Thiopenes Black 4B liquid | III | II | I |
| Thiopenes Black 6BV liquid . . . | III | II | I |
| Thiopenes Black NA | III | II | I |
| Thiopenes Cyanine G | I | I | I |
| Thiopenes Cyanine O | I | I | I |
| Thiopenes New Blue JL | I | I | I |
| Thiopenes New Blue BL | I | I | I |
| Thiopenes Blue B | I | II | II |
| Thiopenes Blue R | I | I | II |
| Thiopenes Blue RR | I | I | II |
| Thiopenes Dark Blue BL | III | II | I |
| Thiopenes Dark Blue BTL | III | II | I |
| Thiopenes Navy Blue R conc. . . . | III | II | I |
| Thiopenes Olive Green GG | II | II | I |
| Thiopenes Olive Green GGN | III | II | I |
| Thiopenes Olive Green G | II | I | I |
| Thiopenes Olive Green B | II | I | I |
| Thiopenes Violet V | III | II | I |
| Thiopenes Violet B | III | II | I |
| Thiopenes Heliotrope O | III | II | I |
| Thiopenes Rubine O | III | II | I |
| Thiopenes Dark Red R | I | I | I |

| Colour | dyed at 68° F. | dyed at 122° F. | dyed at the boil. |
|---|----------------------|-----------------------|-------------------------|
| Thiogene Dark Red G | I | I | I |
| Melanogen Blue B | I | I | I |
| Melanogen Blue BG | I | I | I |
| Thiogene Green B | I | I | I |
| Thiogene Green G | III | I | II |
| Thiogene Green GG | I | I | I |
| Thiogene Green BL extra | III | II | I |
| Thiogene Green GL extra | I | I | I |
| Thiogene Golden Yellow AO | III | II | I |
| Thiogene Yellow GG | III | II | I |
| Thiogene Yellow G | II | I | I |
| Thiogene Orange OG | I | I | I |
| Thiogene Orange RG | III | II | I |
| Thiogene Orange R | II | II | I |
| Thiogene Orange RR | III | II | I |
| Thiogene Brown GC | II | I | I |
| Thiogene Brown yellow shade OG conc. | III | II | I |
| Thiogene Brown GR | III | II | I |
| Thiogene Brown GRR | III | II | I |
| Thiogene Brown R | III | II | I |
| Thiogene Brown RR | III | II | I |
| Thiogene Catechu R | II | I | II |
| Thiogene Brown S | II | II | I |
| Thiogene Bronze G | III | I | II |
| Thiogene Khadi N conc. | I | I | I |

IV. VAT DYEING.

The conversion of Indigo blue to Indigo white can be carried out in various ways, and five different kinds of Vat are to be distinguished:

1. Copperas Vat.
2. Zinc Lime Vat.
3. Hydrosulphite Vat.
4. Zinc-Bisulphite-Soda (or Lime) Vat.
5. Fermentation Vat.

A. Dyeing of Indigo MLB.

I. COPPERAS VAT.

A. Stock Vat.

- 5 lbs. Indigo MLB powder or
- 25 „ Indigo MLB paste 20%
- 20 „ Copperas
- 25 „ Lime.

The Copperas is dissolved in hot water and then added to the Indigo paste; then slaked lime in the form of a cream is added. The temperature of the Stock Vat ought not to exceed 113—122° F. The whole is well stirred and then left until fully reduced. When converting the Indigo powder into a paste, it is advisable to use for this purpose the five fold weight of, boiling water, which is poured on to the powder; the whole is then stirred carefully and mixed with a whisk into an even paste, and finally diluted with warm water.

B. Dye Vat.

For each 100 gallons of water, 1 lb. of Copperas and 2 lbs. of Lime, in the form of Milk of Lime, are necessary. The whole is well stirred and left to stand for 1 hour; then the Stock Vat is added. The liquid is stirred again and then left for 2—3 hours, when the dyeing operation may commence. The liquid should be clear and of a brownish-amber colour, and on gently stirring it, dark blue streaks ought to appear and a coppery scum or flurry float on the top. Before entering the goods, this flurry is removed and added to the Stock Vat.

If the colour of the liquid is greenish, it indicates that part of the Indigo is not reduced, and therefore more Copperas has to be added. On the other hand, if the vat liquid has a darkish appearance, more alkali is wanted and an addition of lime has to be made.

II. ZINC-LIME VAT.

A. Stock Vat.

- 5 lbs. Indigo MLB powder or
- 25 „ Indigo MLB paste 20%
- 3 „ Zinc dust, in
- 10—12 „ Lime.

The Indigo paste is mixed with the slaked lime, then the stated amount of Zinc dust, previously made into a fine paste with 2 gallons of water of 122° F. added. The mixture is stirred from time to time during a period of 5-6 hours. The initial temperature should be 113° F.

B. Dye Vat.

*Before adding the stock vat to the dye vat, 5 ozs. of Zinc dust and 1 lb. of Lime must be added for every 100 gallons of water.

III. HYDROSULPHITE VAT.

This vat is distinguished from the Copperas and Zinc Lime vat by its freedom from sediment.

Shades obtained in the Hydrosulphite Vat are generally, especially in dark shades, slightly greener than those obtained in the former vats.

A. Stock Vat.

- 5 lbs. Indigo MLB powder or
- 25 „ Indigo MLB paste 20%
- 3 gal. (or 1 gal.) lukewarm water, are well mixed and
- 1 1/2 „ Soda lye 76 1/2° Tw. added. The whole is
- well stirred and after heating to 122° F.
- 4 1/2 lbs. Hydrosulphite conc. powder are added.

The temperature of the vat is kept at 113-122° F. In case the colour of the liquid should not be yellow after standing for 1/2-1 hour, another addition of 1/2-3/4 lb. of Hydrosulphite conc. powder has to be made.

B. Dye Vat.

In starting a new vat 1/4-1/2 lb. of Hydrosulphite conc. powder for every 200 gallons of water are added to counteract the effects of oxygen contained in the water. After raking, the vat is left to itself for an hour or two, and then the Stock Vat, or part of it, added. After again stirring and allowing the liquid to rest for a few hours, the dyeing operations may be at once commenced.

The dye vat must not contain too large a surplus of Soda lye or Hydrosulphite, since the Indigo would go too slowly on to the fibre and the shades would not turn out sufficiently dark.

A simpler mode of application is to use Indigo MLB/Vat II instead of the Indigo MLB powder or paste. This is a 20% solution of reduced Indigo, and as it is perfectly free from sediment, is especially suitable for machine and continuous dyeing.

A continuous vat containing 1600 gallons is sharpened with 3 lbs. Hydrosulphite conc. powder and then prepared with:

- 240 lbs. Indigo MLB/Vat II 20% mixed with
- 12 gallons Soda lye 67° Tw.
- 30 „ Hot water 158° F. and
- 20-25 lbs. Hydrosulphite conc. powder.

The vat is stirred from time to time, either mechanically or by hand, and is ready for use as soon as the liquid is a yellow-olive colour.

Under the style of Hoechst Indigo-Soda Vat, we have introduced an improved Indigo-Soda Vat in which Soda, in addition to Soda lye, is used; this has the following advantages:

1. The dyed shades turn out nearly twice as deep as those of other vats. 2. The vat liquid is less slippery, so that it is simpler to wring, squeeze, and hydroextract the goods more perfectly. The dyed shades are consequently faster to rubbing. 3. The Hydrosulphite-Soda vat does not remove the Indigo which is fixed on the fibre. Generally the following mode of application is employed:

Dyeing of Loose Cotton.

A cistern containing about 100 gallons of liquid is prepared initially with 2—2½ ozs. Hydrosulphite conc. powder and 3—4 pints of Turkey Red Oil 50%; then

10 lbs. Indigo MLB/Vat II 20%

½ „ Soda calc. and

¾—1 lb. Hydrosulphite conc. powder.

are added. The dry cotton is entered, worked for 20 minutes and well squeezed. After allowing to oxidise, a further dip or dips are given until the desired shade is obtained. After dyeing, the material is well rinsed, hydroextracted and dried.

In case this vat should become sluggish during working, it must be corrected with Soda lye or Hydrosulphite.

Dyeing of Yarn.

A cistern of 200 gallons capacity is filled with water of ordinary temperature, to which ¼—½ lb. Hydrosulphite conc. powder have been added. To this

10 lbs. Indigo MLB/Vat II 20%

0.8 pints Soda lye 76° Tw.

½ lbs. Soda calc. and

¾—1 lb. Hydrosulphite conc. powder

are added. The yarn is entered wet and worked in the usual manner.

Dyeing of Cops, Cheeses etc. in mechanical Appliances.

The dyevat contains 10 parts of Indigo MLB/Vat II 20% per 1000 parts of water.

The Stock vat is prepared with:

50 lbs. Indigo MLB/Vat II 20%

½ gallon Soda lye 76° Tw.

18 lbs. Soda calc. and

3½—4 lbs. Hydrosulphite conc. powder.

If the concentration of the dye liquid reaches more than 7—9° Tw. the amount of Soda must be diminished.

The improved Hydrosulphite-Soda vat is also suitable for continuous piece dyeing.

We have put upon the market two Hydrosulphite preparations:

1. Hydrosulphite O Hoechst
2. Hydrosulphite conc. powder.

Hydrosulphite O Hoechst is comparatively stable and acts with great certainty in controlling the vats; it must however, be stored in a cool place.

Hydrosulphite conc. powder is 7 times as strong as Hydrosulphite O Hoechst, is easily soluble, and can be added direct to the vat.

A Hydrosulphite solution of 23° Tw. is prepared as follows:

8 gal. Bisulphite of 71.4° Tw. are diluted with 20 gal. cold water, and in the course of $\frac{1}{2}$ an hour 12 lbs. Zinc dust, made into a paste with $1\frac{1}{8}$ gall. water, are stirred into this solution. The whole, which is stirred from time to time, is left to stand for one hour. When the sediment has settled, $1\frac{1}{8}$ gal. of Soda lye of 77° Tw. are added while stirring, the whole allowed to stand for one hour, the clear solution run off and $2\frac{1}{2}$ pints Soda lye of 77° Tw. added.

IV. ZINC-BISULPHITE-SODA (OR LIME) VAT.

This vat has the advantage over the ordinary Hydrosulphite vat that it is cheaper, but on the other hand, it contains sediment.

A. Stock Vat.

- 5 lbs. Indigo MLB powder or
- 25 „ Indigo MLB paste 20%, are made into
a paste with
- 4 gallons or 2 gallons of water, then
- $1\frac{1}{4}$ „ Bisulphite of Soda 72—77° Tw. are
added, the whole stirred well and
- $2\frac{1}{8}$ lbs. Zinc dust, previously mixed with warm
water, added.

After stirring for $\frac{1}{2}$ an hour, and allowing to stand for another $\frac{1}{2}$ hour, $1\frac{1}{4}$ gallons Soda lye 76 $\frac{1}{2}$ ° Tw. are added and the whole made up with water to about 15 gallons.

The stated amount of Soda lye can be replaced by 8 lbs. Lime, previously slaked with water. The initial temperature of the stock vat should be 113—122° F.

The reduction is completed as soon as the liquor shows a golden-yellow colour, which takes place in about $\frac{1}{2}$ an hour after Soda lye or Lime have been added.

B. Dye Vat.

Before pouring the stock vat into the dye vat, the effect of oxygen is counteracted by adding for every 500 gallons:

- 1 pint Bisulphite of Soda 72—77° Tw. diluted with
- 3 pints water, to which are added
- 2 ozs. Zinc dust.

After stirring for 10 minutes and allowing to stand for 20 minutes the smell of Sulphurous acid will have disappeared. Then the mixture is poured into the dye vat, stirred and

$\frac{1}{2}$ pint Soda lye 76 $\frac{1}{2}$ ° Tw. or
5 ozs. Lime are added.

After raking and allowing to stand for $\frac{1}{2}$ —1 hour, the stock vat or part of it is added to the liquid; the latter is again stirred and after allowing the sediment to settle 1 hour, the dyeing operations may be at once commenced

V. FERMENTATION VAT.

The vat may or may not be artificially heated. The reducing substances used in this vat are woad, bran, flour, dates, molasses etc. etc., all substances which contain considerable amounts of sugar or starch and ferment easily in an alkaline solution.

The quantities for setting the stock vat are as follows:

5 lbs. Indigo MLB powder or
25 „ Indigo MLB paste 20%
12 „ Bran
12 „ Calcined Soda and
8 „ Madder.

The dyestuff is reduced in about 24—36 hours. The liquid, which initially has a muddy appearance, becomes gradually greenish and after the addition of Lime is of a golden-yellow colour. The sickly smell of the fresh vat disappears and gradually becomes more pungent, which indicates the correct condition of the vat. When stirred, the liquid will show blue veins and a coppery froth will be swimming on the top of it.

For setting Fermentation vats Indigo MLB/Vat II 20% may be used instead of MLB powder or paste.

The dyeliquid is heated to 122° F. then 8 lbs. Bran, 2 lbs. Flour and 2 lbs. Calcined soda are added for every 100 gallons of water, the vat allowed to stand for 8—10 hours, after which time as light fermentation will have taken place. Then 8 lbs. Indigo MLB/Vat II 20% are added and the liquid sharpened with Lime or Soda. After raking and allowing 1—1 $\frac{1}{2}$ hours for the impurities to settle, work can be commenced.

Still simpler is the application of Indigo MLB/W for fermentation vats. This preparation has the advantage over the ordinary Indigo that it may be added to well-conditioned fermentation vats direct, which will be ready in 2 hours time to start the dyeing operations.

The vat can be replenished twice or three times daily with Indigo MLB/W, whereas ordinary Indigo can scarcely be added more than once. Approximately 10% of Lime of the weight of Indigo MLB/W are used to dissolve the latter.

B. Dyeing with Indigo-Derivatives and Helindone-Dyestuffs.

| | |
|------------------------|---------------------------|
| Indigo MLB/R, MLB/RR, | Helindone Fast Scarlet R, |
| MLB/T, MLB 2B, MLB/4B, | Helindone Orange R. |
| MLB/5B, MLB/6B, | Helindone Brown G, |
| Helindone Red B, 3B, | Helindone Yellow GN. |
| Helindone Scarlet S, | |

Indigo MLB/R, MLB/RR and MLB/2B are dyed in the Hydrosulphite-Vat, more seldom in the Fermentation-Vat. We do not recommend the Zinc-lime or sulphate of iron vat.

The dyeing is carried out in almost exactly the same manner as with Indigo MLB, the brands MLB/RR and MLB/2B may also be dyed at 105–120° F.

Indigo MLB/T is faster to Chlorine, brighter and greener than Indigo MLB and is dyed in all vats used for the latter, but best in the Hydrosulphite-Vat. When mixed with Indigo MLB/R, or MLB/RR dyeings are obtained superior as regards brilliancy and fastness to chlorine to those obtained with Indigo MLB, but of the same shade.

Indigo MLB/4B, MLB/5B and MLB/6B are especially bright Indigo-Brands. They are dyed in the Hydrosulphite-Vat at 125–160° F. In the case of Indigo MLB/4B a stock-vat is prepared, Indigo MLB 5B and MLB/6B are reduced in the dye-vat. The dyeings are brightened at the boil with 2 parts soap or 1 part soap and 1 part soda per 1000 parts, or they may be aftertreated for $\frac{1}{4}$ hour at 140–160° F. with 1–2% bichrome and $\frac{1}{2}$ –1% acetic acid.

The Helindone Colors are dyed as follows:

The standard vats and the dye vats must be prepared with water which is freed from lime and in which the oxygen has been neutralised by the addition of a little Hydrosulphite. For 200 galls. of water 6 $\frac{1}{4}$ –9 $\frac{1}{2}$ oz. of Solvay soda and 6 $\frac{1}{4}$ oz. of Hydrosulphite conc. powder are required. The whole is stirred, allowed to stand for several hours until the lime has settled and then the clear water is used for dyeing.

The standard vats are set as follows:

The dye is mixed with the stated amount of water, (see table) either warm or cold, in accordance with the temperature of the vats, the soda lye and the Turkon oil N added, the whole well stirred and Hydrosulphite conc. powder slowly scattered in. In $\frac{1}{4}$ to $\frac{1}{2}$ hour the vat is ready for use.

If dyes are to be mixed it is advisable to reduce them separately and then to add them to the dye vat. The temperature must be suited as nearly as possible to the two products when dyeing mixed shades, so that they exhaust at an equal rate.

The dyestuff solution, which is run for the sake of precaution through a fine sieve, is poured into the dye vat which contains the clear prepared water. After stirring well the yarn is entered on bent sticks, worked round 3 or 4 times in the $\frac{1}{2}$ hr., squeezed once and evenly oxidised. After oxidised the goods are soaped at the boil for $\frac{1}{4}$ – $\frac{1}{2}$ hr. with 2 parts of soap or 2 parts of soap and 1 part of soda calc per 1000, rinsed and then dried.

When dyeing Helindone Yellow 3GN paste and Helindone Brown 3GN paste, either alone or combined more or less common salt or Glauber's salt must be added.

The green shades obtained with Helindone Yellow 3GN and Indigo MLO or MLB/T are treated for $\frac{1}{4}$ — $\frac{1}{2}$ hr. after dyeing and oxidising with boiling water only.

The quantities given in the table refer to 200 lbs. of yarn and 400 galls. water, for first baths and one passage.

Helindone Red B, 3B, Helindone Orange R. The first two are bright blueish reds, the last a brilliant orange. For dyeing, water which is free from lime or has been corrected with soda must be used. The goods are dyed at 85—125° F. in one or several passages and soaped at the boil with 2 parts per 1000.

Helindone Red with Indigo MLB/4B, MLB/5B or MLB/6B gives very fast bright violet shades; when cross-dyed with Alizarine very fiery fast Scarlet tones. Combined with Helindone Orange, Helindone Red gives all kinds of red shades.

Helindone Scarlet S is a bright fast Scarlet, but only to be employed for dark shades. This is also developed after dyeing by soaping at the boil or some other treatment. The fastness to light may be improved by treating with copper sulphate.

Helindone Fast Scarlet R is still faster especially as regards fastness to light than Helindone Scarlet S and is therefore adapted for finer material. It is also developed by soaping.

Helindone Brown G is a bright yellowish Brown which is also soaped after the dyeing. The stock-vats are not stable and must therefore only be prepared for immediate use.

Helindone Yellow 3GN is a bright fast yellow. It is dyed with an addition of Common Salt to the dye-vat and developed by soaping. Combined with Indigo MLB or MLB/T it gives very fast Greens. In this case it is developed with boiling water instead of by soaping.

In the following table we give the necessary amounts of Hydro-sulphite, Alkalies etc. for the reduction of the vat dyes.

VAT DYEING TABLE: INDIGO

20 lbs. of paste dyed

| Dye | Dye made into paste with water | Soda lye 77° Tw. | lbs. Soda calc. | Turkone Oil N | lbs. Hydro-sulphite conc. powder |
|--|--------------------------------|------------------|-----------------|----------------------------|----------------------------------|
| Helindone Yellow 3GN paste (pat. applied for) | 8 gall. | 1 gall. | — | — | 8 |
| Helindone Orange R paste (pat. applied for) . . | 4 „ | 1½ pts. | 2 | — | 2 |
| Helindone Scarlet S paste (pat. applied for) . . | 4 „ | 2½ „ | — | ¾ pts. | 2 lbs. 6 ozs. |
| Helindone Fast Scarlet R paste pat. | 6 „ | 3¼ „ | — | 1½ „ | 3 |
| Helindone Red B paste (pat. applied for) . . | 10 „ | 6½ „ | — | 3¼ „ | 5 |
| Helindone Red 3B paste 20% (pat. applied for) | 10 „ | 6½ „ | — | 5¼ „ | 5 |
| Helindone Pink B paste (pat. applied for) . . | 10 „ | 1—1½gall | — | 1½—1gall. | 8 |
| Helindone Brown G paste (pat. applied for) . . | 8 „ | 3¼ pts. | — | 1½ pts. | 2½ |
| Helindone Brown 3GN paste (pat. applied for) | 8 „ | 1 gall. | — | — | 8 |
| Indigo MLB/T paste 20% pat. | 5 „ | 1gall.1½spt. | — | — | 4 |
| Indigo MLB paste 20% pat. | 5 „ | 4½ pts. | 8 | — | 4 |
| Indigo MLB/R paste 20% pat. | 5 „ | 1gall.1½spt. | — | — | 4 |
| Indigo MLB/2R paste 20% pat. | 5 „ | 1gall.1½spt. | — | — | 4 |
| Indigo MLB/2B paste 20% pat. | 5 „ | 1gall.1½spt. | — | — | 4 |
| Indigo MLB/4B paste 20% (pat. applied for) . . | 16 „ | 6½ pts. | 8 | 3 pts. | 8 |
| Indigo MLB/5B paste 20% (pat. applied for) . . | — | 1 gall. | — | 3 „ | 5 |
| per 1000 parts dye vat | | | | | |
| Indigo MLB/6B 20% | Soda lye 77° Tw. | Soda calc. | Turkone Oil N | Hydrosulphite conc. powder | |
| parts | parts | parts | parts | parts | |
| 1 | 2 | 2 | 1 | 1 | |
| 5 | 5 | 5 | 2 | 1,5 | |
| 10 | 6 | 6 | 4 | 2,5 | |

AND HELINDONE DYESTUFFS.

are reduced as follows:

| Temperature of stock vat in ° F. | Appearance of stock vat (Test on glass plate) | Best temperature of dye vat in ° F. | Approx. exhaustion of baths 1 dip of 30 min. prop. of goods to liquid 1:20 |
|----------------------------------|--|-------------------------------------|--|
| 60—105 | blood red, turns very slowly reddish yellow | 60—85° | 50—80% ¹⁾ |
| 140 | pale yellow, slowly turning to orange | 60—105° | 50—65% |
| 120—140 | moss green, rapidly turning red | 60—85° | 50% ²⁾ |
| 140—160 | blueish green, quickly turning to a dullish red | 140° | 50—80% |
| 140 | olive yellow, rapidly turning brownish-red | 140° | 50—65% |
| 140 | olive green, slowly turning Magenta red | 140° | 50—65% |
| 120—140 | dark yellow, rapidly turning blueish red | 105° | 75—85% |
| 120 | pale yellow, slowly turning brown | 105° | 50—60% |
| 75—95 | reddish brown, slowly turning to yellow brown | 60—85° | 50—80% ³⁾ |
| 110—120 | green yellow, turning at once blue | 60—75° | 15% |
| 110—120 | golden yellow, orange, slowly turning green and finally blue | 60—75° | 12—15% |
| 110—120 | golden yellow, orange, slowly turning green and finally blue | 60—75° | 15—20% |
| 110—120 | golden yellow, orange, quickly turning to blue | 60—75° | 50—65% |
| 110—120 | golden yellow, quickly turning to blue | 60—75° | 50—65% |
| 140 | golden yellow, slowly turning green and then blue | 140° | 65—85% |
| — | dye vat: golden yellow, quickly turning blue | 140° | 60—75% ⁴⁾ |
| — | dye vat: golden yellow, slowly turning blue | 150° | 60—75% ⁵⁾ |

Observations (see p 137).

¹⁾ Helindone Yellow 3GN is dyed with salt. 20—50 parts common salt or twice the amount of Glauber's salt cryst. per 1000 are employed according to concentration of the dye vat. The salt is added direct to the dye vat

²⁾ The fastness to light is increased by cold or hot aftertreatment with 2% sulphate of copper and 1% acetic acid.

³⁾ Is dyed with salt. 20—50 parts common salt or twice the amount of Glauber's salt cryst. per 1000 are employed according to concentration of the dye vat. The salt is added direct to the dye vat.

⁴⁾ Is reduced in the dye vat.

⁵⁾ Is reduced in the dye vat and requires more or less lye, soda, Hydrosulphite and Turckone oil according to concentration of the dye vat.

Indigo Tests on the Fibre.

In order to ascertain whether a shade is dyed with Indigo, the material is spotted with strong Nitric acid; this yields a yellow spot surrounded by a green rim if the goods are dyed with Indigo alone, but if Indigo is used in combination with other colours, a more brownish spot results.

A more valuable and reliable test is to ignite a sample of the dyed material in a porcelain dish, whereupon, in the case of Indigo being present, blue vapours sublimate on to the colder part of the vessel.

Boiling glacial Acetic acid and Phenol strip the Indigo entirely from the fibre; the analysis of Indigo on the fibre is based on this reaction.

Indigo Analysis.

One gramme of the well dried Indigo sample is weighed into a short wide tube; then 7 ccm Sulphuric acid 169° Tw. are added and the whole heated for $\frac{1}{2}$ an hour in a steam-bath at about 203° F. The solution is then poured into 100 cc cold water and filtered into a 1 litre wash bottle. After washing the filter with hot water until the latter is perfectly colourless, the solution and washwater are filled up to exactly 1 litre.

20 cc of this solution are diluted with 300 cc distilled water in a white porcelain dish of $\frac{1}{2}$ litre capacity, and titrated with a Permanganate solution containing $\frac{1}{2}$ gramme KMnO_4 per litre. The Permanganate solution is added in drops, whilst constantly stirring the Indigo solution. The titration is finished when the blue has changed to gold yellow without any green reflexion.

For comparison, a very pure Indigo of known percentage is always analysed simultaneously with the new sample. This enables one to find the percentage of the latter by a simple equation:

A = Indigo of known percentage requires 17,2 cc Permanganate

B = Indigo of unknown percentage requires 16,6 cc Permanganate

A = contains 99% Indigo

therefore: B: 99 = 16,6 : 17,2

B = 95,5 %.

V. DYEING WITH MORDANT COLOURS.

The most important application of Mordant colours is that of Alizarine for Turkey Red dyeing.

Turkey Red is dyed either by the Old Red or the New Red process. Sometimes a Mixed Red is produced, the latter occupying a position between the two former methods.

The Alizarine "Old Red" yields shades of extreme fastness, but requires a considerable number of passages which are closely connected one with the other, and the directions must be strictly adhered to, in order to obtain good results. For this process Tournant oil (a rancid Olive oil) is the most suitable oil mordant. An emulsion of it is made with Water and Potassium Carbonate; in this, the fibre is repeatedly steeped and dried alternately, and thus the oil mordant intimately fixed upon the fibre. The Sulphate of Alumina (neutralised with Soda or Chalk) is employed as a further mordant.

The Alizarine "New Red" is obtained by replacing the Olive oil by the cheaper Turkey Red oil. Moreover, the numerous processes of passing the material alternately through oil and drying are dispensed with, and thus the dyeing operation considerably simplified. One or two passages through oil and subsequent drying prove sufficient for New Red. Here also Alumina salts serve as a mordant; directly after mordanting, the goods are generally dried and passed through a Chalk-bath.

Tournant oil is a rancid Olive oil; (it is generally made rancid by artificial means) — Turkey Red oil is sulphonated Castor oil.

A. Yarn Dyeing.

I. ALIZARINE OLD RED.

1. Boiling. The raw material is boiled under pressure with 3% calcined Soda and then washed.

2. First Oiling. The first oiling bath contains 1 lb. of Tournant oil per gallon (100 g in 1 litre) of liquor, and is made up to 9° Tw by an addition of Potash. The hydroextracted yarn is passed through this bath, aired for 1 hour and then dried at 140° F.

3. Second Oiling. After drying, the yarn is passed through a second oil bath, which contains $6\frac{3}{4}$ ozs. of Tournant oil and $13\frac{1}{2}$ ozs. of Turkey Red oil per gallon (40 g and 80 g in 1 litre) and is made up to 6° Tw with Potash. After hanging the oiled yarn in the open air for 4 hours it is dried at 140° F.

4. Third Oiling. The second oiling liquor is diluted with water and Potash to 5° Tw.; the yarn is then passed through, again hung in the open air for 4 hours and finally dried at 140° F.

5. First Soaking. The dried material is soaked in a solution of Potash of $\frac{1}{2}$ ° Tw. for 3 hours at 86° F., then hydroextracted and dried at 140° F.

6. **Second Soaking.** The dried yarn is steeped in warm water of 86° F. for 3 hours, and then hydroextracted.

7. **Sumaching.** For every 1 lb. of yarn about 2 oz. (60 g) of Sumach leaves are required. The yarn is steeped in the Sumach decoction (104° F.) and after 6 hours, hydroextracted and then mordanted.

8. **Mordanting.** 8 lbs. (4 Ko) of Alumina Sulphate (free from iron) are dissolved in 3.5 gallons (16 litres) of hot water, and when cold a solution of 12½ ozs. (400 g) of Soda calc. in 6 pints (4 litres) of water is added. This mordant is made to twaddle at 7.2° by diluting with water, then the yarn is immersed for 24 hours. Finally, it is well washed.

9. **Dyeing.** Usually 9% Alizarine paste 20% are required for dyeing. For reds, which are perfectly fast to bleaching, Alizarine Red No. 1 is used. The mordanted yarn is dyed ¼ hour cold, then the dye liquid heated to the boil within 1½ hours and boiling continued for ½ an hour.

10. **Softening.** 100 lbs. of yarn (for yellow shade) are softened with 1 lb. Soda calc. 1 lb. Soap and 3—4 ozs. Tin salt. For a blue shade only Soap and Soda are used. The dyed and washed material is boiled in this solution for 4 hours under a pressure of 1 atm. and washed again. Reds fast to rubbing are obtained by repeating this operation. Then the yarn is washed and dried at a low temperature.

For **Old Pink** the oil bottom remains unaltered, only the strength of the mordant is reduced to 4° Tw. In all other respects the manipulation remains the same as with Old Red; the yarn, however, is often softened twice, first with Soda and then with Soap and Soda.

Old Claret Red is manipulated in the same manner as Old Red, blue shade; for dyeing, however, Alizarine Claret R is used alone, or in conjunction with Alizarine Red.

II. MIXED ALIZARINE RED.

The shades obtained according to this process excel "New Red" in point of fastness to rubbing and washing, but do not come up to the standard of Old Red shades.

The oiling differs from that employed for "New Red", in as much as unwashed Red oil is used; on the other hand the addition of Potassium Carbonate and the soaking is carried out exactly as in dyeing Old Red.

Directions for dyeing 600 lbs. of yarn:

1. **Boiling.** The yarn is boiled for 5 hours with 3% Soda calc. under a pressure of 2 atm., well washed and hydroextracted.

2. **First Oiling.** 86 lbs (39 Ko.) of Castor oil Ia are gradually mixed with 12½ lbs. (5¼ Ko.) of concentrated Sulphuric acid; this is allowed to stand for 36 hours, and then 1¾ pints (1 l) of Ammonia 25%, and after a further 12 hours, 33 gallons (150 l) of soft warm water are added. The mixture is neutralised

with 9 pints (5 l) of Ammonia 25%, and the whole is made up to 50 gallons (230 l) of 7.2° Tw. with 9½ gallons (40 l) of a Potash solution of 64° Tw.

3. Second Oiling. The first oiling liquid is made up with water and Potash solution (64° Tw.) to the quantity necessary to work the yarn, which is passed through at 104° F., hydroextracted and dried at 140° F.

4. Soaking. The dried yarn is steeped for 4 hours in water of 86° F., then hydroextracted and dried.

5. Mordanting. 110 lbs. (50 Ko.) of Alumina Sulphate are dissolved in 83 gallons (375 l) of water; 2¼ lbs. (1 Ko.) of Tannic acid are added and the solution allowed to cool down. Gradually 11 lbs. (5 Ko.) of French Chalk are stirred into the liquor which, when clear, is drawn off and made up to 8° Tw. The yarn is passed through and left to lie in it over night. Finally it is well washed and slightly hydroextracted.

6. Dyeing. The dyebath is prepared with 8—10% Alizarine 20% and for each 100 lbs. of yarn, 7 ozs. (200 g) of Tannic acid are added (hard water must be corrected with Acetate of Lime or Acetic acid). The yarn is worked cold for ½ an hour, the temperature raised to the boil in 1½ hours and kept at the boil for ½ an hour.

7. Boiling in water. The dyed yarn is boiled with water in a closed vessel for 2 hours under a pressure of 1 atm. then lifted and washed.

8. Clearing. For 600 lbs. of yarn 10 lbs. of Soap and 2 lbs. of Soda are required, and for yellow shades 1 lb. of Tin crystals are added; the yarn is boiled for 2 hours under a pressure of 1 atm. washed, hydroextracted and dried.

III. ALIZARINE NEW RED.

The characteristic feature of this process is the use of a sulphonated oil mordant (the so-called Turkey Red oil) which is obtained by the action of Sulphuric acid on Castor oil.

The operations are as follows:

Oiling with Turkey Red oil,
Drying,
Mordanting with Alumina mordant,
Drying,
Fixing in a Chalk bath,
Washing,
Dyeing,
Steaming,
Clearing.

1. Boiling. The raw material is boiled with 3% Soda calc. or Silicate of Soda 76° Tw. and then washed. Large batches are best boiled in a closed vessel for 4 hours under pressure of 2 atm.

2. Oiling. After hydroextracting, the moist yarn is passed through a solution of 20—24 ozs. (120—150 g) of Turkey Red oil

50% per gallon (1 l) of liquid and then dried at 150° F. for 12 hours. This operation is repeated. If the yarns are dried beforehand, one pass through the oil solution is sufficient.

3. Mordanting. 9 lbs. (4 Ko.) of Alumina Sulphate (free from iron) are dissolved in 3 1/2 gallons (16 l) of hot water, and when cold a solution of 14 ozs. (400 g) of Soda calc. in 1 gallon (4 l) of water and 4 ozs. (100 g) of Chalk made into a paste with water, are added; when the Carbonic acid reaction has ceased, an addition of 1/2 pint (300 cc) of Acetic acid 50% is made; before use this concentrated mordant is diluted with water to 12° Tw. The oiled yarn is passed dry through the mordant at 86° F., and then left to lie in a cistern over night, and finally hydroextracted and dried below 104° F.

Instead of the above mordant, an Alumina Acetate mordant, made of commercial Basic-Alumina-Carbonate is frequently used. (This mordant is regularly employed in piece dyeing). The yarn is mordanted with Alumina Acetate 7° Tw. and the manipulations carried out as described above.

Acetate of Alumina.

18 lbs. (9 Ko.) Sulphate of Alumina (free from iron) are dissolved in 13 gallons (64,5 l) water, free from iron.

5 3/4 lbs. (2 1/2 pints) (2,85 Ko.) Sulphuric acid 168° Tw. and 34 3/4 lbs. (3 1/2 gallons) (17,4 Ko.) Acetic acid 40% are added. The mixture is well stirred and then

17 3/4 lbs. (8,9 Ko.) Basic-Alumina-Carbonate are added in several portions at 95—104° F.; the latter dissolves readily under effervescence.

The solution is allowed to stand for a short time and then drawn off, leaving a small residue.

200 lbs. = 20 gallons (100 Ko.) stable Acetate of Alumina 23,2° Tw. free from iron are thus obtained; the solution is finally diluted to 7—9° Tw.

4. Fixing. Fixing liquid contains 1 oz. of Chalk or 1 oz. of Sodium Phosphate per gallon. The dried mordanted yarn is worked at 120° F. for 1/2 an hour in this liquid and then thoroughly washed.

5. Dyeing. 8% Alizarine 20% are generally used. By combining Alizarine No. 1 (blue shade) and Alizarine 5F (yellow shade) all current shades of Turkey Red are obtained. For water of 7 1/2 hardness, an addition of 10% Acetate of Lime 28,5° Tw. and 3% of Tannin (both referring to the amount of Alizarine used) is made. The yarn is dyed cold for 1/2 an hour, the bath heated during 1 hour to 194° F. and the dyeing operation continued at this temperature for another 1/2 hour. Then the yarn is quickly rinsed, hydroextracted and dried. The addition of 2% Turkey Red oil (50%) (referring to the weight of yarn) to the dye bath increases the brilliancy of the shade considerably.

6. Steaming. The yarn is steamed for 2 hours under pressure of 1 atm. (If the yarn, after dyeing and hydroextracting, is put wet into the steaming apparatus, uneven results are often obtained, especially in manipulating large batches.)

7. Soaping. The steamed yarn is soaped at 195° F.; (solution: 1 oz. in 3 gallons). In order to obtain a purer red the yarn is boiled in a closed vessel for 1 hour. — After washing, the yarn is dried at a low temperature. To obtain a red of greater brilliancy and fastness, the yarn is boiled in a closed vessel for 2 hours under pressure of 1 atm. with 3½ ozs. Soap, ½ oz. Solvay Soda and ¼ oz. Tin salt per 10 gallons of liquid.

IV. ALIZARINE NEW PINK.

For all pink shades, bleached yarn is used; it is oiled twice with ½—1 gallon of Turkey Red oil 50% per 10 gallons liquid. After each oiling operation the yarn is dried. Then the yarn is mordanted with "Acetate of Alumina 4° Tw. for pink", dried at 100° F. and fixed as described under "Red"; then dyed with ½—3% Alizarine blue shade, 0.1—0.3% Acetate of Lime 29° Tw., first cold for ½ an hour, then at 170° F. for another hour. After rinsing, the yarn is steamed for 2 hours under pressure of 1 atm. and finally soaped (solution: 1 oz. Soap per 3 gallons liquid) at 140° F. for ½ hour.

Acetate of Alumina for Pink.

- I. { 6 lbs. Alum free from iron, dissolved in
2 gallons Hot Water.
- II. { 4½ lbs. Sugar of Lead dissolved in
1 gallon Hot Water.

Solutions I and II are mixed hot; after allowing the precipitate to settle, the clear solution is drawn off and made up to 4° Tw. before use.

V. ALIZARINE CLARET RED.

Alizarine Claret Red is dyed upon New Red bottom with Alizarine Claret R, alone or in combination with a blue shade of Alizarine Red. By adding some Alizarine Brown, very dark Claret Reds can be obtained.

The manipulations of mordanting, dyeing etc, are the same as described under Alizarine Red.

VI. SIMPLIFIED TURKEY RED METHOD.

In many cases Alizarine New Red has been replaced by the cheaper Parantraniline Red etc.

Consequently, the need has been felt of dyeing Alizarine New Red by a shorter and cheaper method. Various processes have been discovered and a number of patents taken out for carrying these processes out.

In the first patent, the yarn, without having been separately mordanted and fixed, is mordanted, fixed and dyed in one bath. This is possible by the addition of Formates or other easily

dissociating salts of Alumina, Chromium or Iron, to the dyebath. The fastness to rubbing and the evenness of the shades produced by this process did not, however, meet with full approval and therefore necessitated the introduction of another method, in which, in place of Formates, Sulphites, Bisulphites or Pyrosulphites of Alumina, Chromium and Iron are added to the bath, in which the previously oiled yarns are dyed at the boil.

This process was further improved: the oiled material is treated in diluted baths of non-dissociating Alumina salts and dyed directly after rinsing.

In practice, three different modes of application are followed, which are distinguished mainly by their different methods of mordanting.

1.

The well boiled, hydroextracted or dried yarn is first oiled. For 100 lbs. of yarn, 20 lbs. (9 kilos) Ammonia Turkey Red oil or 20 lbs. (9 kilos) Sodium Turkey Red oil with the addition of 7 pints (4 litres) Sodium Aluminate 32° Tw. are used. The material is treated in this bath for some time and then slowly dried at 140° F.

When quite dry, the yarn is mordanted. It is advisable to prepare the mordanting bath with the 25 fold amount of water, as compared with the weight of the material. Per 1000 parts water

18 parts normal Acetate of Alumina 9½° Tw. and
1,8 „ Acetic acid 50% are used.

After giving one turn, the liquid is heated within ½ an hour to 110° F., and the material worked for ¼ of an hour at this temperature.

The yarn is then washed until perfectly neutral.

Dyeing, steaming and soaping are carried out as stated under New Red.

2.

The manipulations of boiling and oiling are the same as given above, but the mordanting bath is prepared per 1000 parts water with:

3,1 parts Sulphate of Alumina
11 „ Acetate of Lime 28½° Tw.
1,85 „ Acetic acid 50%.

The temperature, and manipulations of mordanting, washing, steaming and soaping, follow exactly the directions given above.

3.

The mordanting bath for the third process contains per 1000 parts water

3,1 parts Sulphate of Alumina
1,6 „ Sodium Pyrosulphite.

The application is similar to the one described above.

Besides Red, very even Pink shades can be obtained by this process.

The colours suitable for these processes are:

Alizarine Red, all brands,
Alizarine Claret R,

Alizarine Orange,
Anthrol Blue NR paste, NG paste.

VII. ERBAN SPECHTS PROCESS.

This process is suitable for the production of pink and fancy shades.

The Alizarine dyestuffs are dissolved in water, free from lime, by means of Ammonia or dissolving Ether MLB, or a mixture of both, then diluted and mixed with neutral Turkey Red oil. The well bleached cotton is impregnated with this liquor, then dried at 130—140° F., and passed through a second bath which contains the required mordants (Alumina, Chrome, Acetate of iron, Acetate of lime). The material is wrung evenly, or passed through squeezing rollers and then either dried first or steamed in the moist state for 1—2 hours with or without pressure; finally the cotton yarn is soaped and softened. The following colours may be applied by this method.

| | |
|------------------------------|-----------------------------|
| Alizarine Yellow 5G, GG, R, | Ceruleine paste A, |
| Mordant Yellow O, | Alizarine Green S, |
| Alizarine Orange, | Phlochromine B and G paste, |
| Alizarine Red, all brands, | Chrome Violet, all brands, |
| Alizarine Claret R paste, | Alizarine Blue, all brands. |
| Alizarine Brown, all brands, | |

Directions for Pink shades:

Alizarine solution: 1 lb. Alizarine paste 20%,
 1 gall. 2½ pts. Water (free from lime),
 1.6 pts. Ammonia 25%.

| | Pink. | Pink. | Pink. |
|------------------------|----------------|----------------|----------------|
| I. Bath: | 1. | 2. | 3. |
| Water (free from lime) | 8 gall. 6 pts. | 8 gall. 3 pts. | 7 gall. 3 pts. |
| Neutral Turkey Red oil | | | |
| 80% sol. 1:4 . . . | 1 ,, 1 ,, | 1 ,, 1 ,, | 1 ,, 1 ,, |
| Alizarine solution . . | 1 ,, | 4 ,, | 1 ,, 4 ,, |
| | 10 gall. | 10 gall. | 10 gall. |

II. Bath:

| | | | |
|------------------------------------|-------------|-----------|-----------|
| Water | 10 gall. | 10 gall. | 10 gall. |
| Acetic acid 12° Tw. | 0.8 gills | 0.8 gills | 0.8 gills |
| Acetate of Alumina 19° Tw. | 0.45 gills | 1.8 gills | 1.3 pints |
| Acetate of Lime 29° Tw. | 0.075 gills | 0.3 gills | 0.9 gills |

In order to obtain very blue shades, only one half of the given amounts of Acetic acid and Acetate of Lime (II. Bath) are used.

III. Bath:

| | |
|------------------|---|
| 10 gall. Water | } 2 hours under a pressure of 2 atm. |
| 0.8 oz. Soda | |
| 0.16 ,, Tin salt | |
| 0.8 ,, Soap | |

Acetate of Alumina 19° Tw.

| | |
|-------------------------------|--|
| { 3 lbs 14 ozs. Alum | |
| { 3 1/4 pints Water | |
| { 3 lbs. 3 ozs. Sugar of Lead | |
| { 2 1/2 pints Water. | |

The Alum and Lead Acetate are dissolved separately and the solutions then mixed together. After precipitating the Sulphate of Lead, and cooling,

5 ozs. Soda crystals

are added, and the whole allowed to settle for 24 hours; the clear liquor is then drawn off and made to up to 19° Tw.

If Acetate of Iron is used as a mordant, Lilac shades are produced.

This method can also be employed for Fancy shades.

The yarn (which must be bleached if light shades are required) is passed through Bath I (Alizarine solution), wrung evenly, dried at 140° F. and then passed into the second bath (Mordant solution). After wetting, it is carefully and evenly wrung, and then either dried, or in its moist state developed by steaming for 1—2 hours without or with very slight pressure.

The colour solutions are made up as follows:

| for light shades: | for dark shades: |
|--|--|
| 1 1/2 ozs. Paste Dyestuff made into paste with | 1 lb. 8 ozs. Paste Dyestuff made into a paste with |
| 2 7/8 gills Water, | 6 1/2 quarts Water free from lime, |
| 4 1/2 gills Water free from lime, | 1 3/4 gills Ammonia, 25°/o |
| 1 1/2 gills Ammonia 25°/o (1:10), | 2 1/2 gills Dissolving Ether MLB, |
| 3 gills Turkey Red oil 80°/o | 2 1/2 „ Turkey Red oil 80°/o, |
| (1:4), | 2 gall. |
| 2 gall. | |

When using Alizarine Brown and Ceruleine, it is advisable to filter the solutions.

The Mordant solutions are prepared as follows:

a) Alumina Mordant.

| for light shades: | for dark shades: |
|---------------------------------|--------------------------------|
| 7 1/4 quarts Water, | 5 3/4 quarts Water, |
| 1 1/2 gills Acetic acid 12° Tw. | 2 1/2 pints Acetate of Alumina |
| (1:10), | 15° Tw, |
| 1 „ Acetate of Alumina | 3 gills Acetate of Lime |
| 15° Tw., | 28, 1/2° Tw., |
| 0 3 „ Acetate of Lime | 2 gall. |
| 28, 1/2° Tw., | |
| 2 gall. | |

b) Chrome Mordant.

for light shades:

| | |
|------------------------|---------------------|
| 7 $\frac{1}{2}$ quarts | Water, |
| 1 $\frac{3}{4}$ gills | Acetic acid 12° Tw. |
| | (1:10), |
| 1 $\frac{1}{2}$ „ | Acetate of Chrome |
| | 32,4° Tw., |
| 1 $\frac{1}{6}$ „ | Acetate of Lime |
| | 28,4° Tw., |

2 gall.

for dark shades:

| | |
|------------------------|-------------------|
| 6 $\frac{3}{4}$ quarts | Water, |
| 5 $\frac{1}{4}$ gills | Acetate of Chrome |
| | 32,4° Tw., |
| 1 $\frac{3}{4}$ „ | Acetate of Lime |
| | 23,4° Tw., |
| | 2 gall. |

c) Iron Mordant (for Lilac shades).

| | |
|------------------------|-----------------------------|
| 7 $\frac{1}{2}$ quarts | Water, |
| 1 $\frac{3}{4}$ gills | Acetic acid 12° Tw. (1:10). |
| 1 $\frac{3}{4}$ „ | Acetate of Iron 15° Tw., |
| 1 $\frac{1}{6}$ „ | Acetate of Lime 28,4° Tw., |
| | 2 gall. |

DIRECTIONS FOR DYEING ON OTHER MORDANTS:

a) On Iron and Alumina Iron mordant.

Light and dark violet and claret shades are obtained on an Iron mordant with the blue shades of Alizarine Red and Alizarine Claret R.

For lilac and claret shades fast to chlorine, the yarn is treated first as for Old Red and worked in a bath containing Pyrolignite of Iron for $\frac{1}{2}$ —1 hour, then washed, dyed and soaped; for shades less fast to chlorine the treatment as described under New Red will be found sufficient; the yarn may also be padded with $\frac{1}{2}$ oz. Tannin per gallon of liquid and then passed through a bath of Pyrolignite of Iron 3° Tw., washed, dyed, and soaped.

For Claret Red shades the yarn is either: (1) oiled, sumached, then mordanted with Basic-Alumina-Sulphate (Old Red bottom), rinsed and finally treated with Pyrolignite of Iron, or (2) it is treated first with Alumina (as for New Red), rinsed, passed through a cold solution of Pyrolignite of Iron, washed, dyed and soaped; or (3) the yarn is worked for 1 hour in a bath containing a mixture of Alumina and Iron mordants, rinsed, dyed and finally soaped.

b) On Chrome mordant.

Dyeing on a Chrome mordant is rather more expensive on account of the various manipulations which are required, the method however is still largely used in practice for the dyeing of yarn and piece goods, whenever special fastness to light, to boiling or to bleaching (unattainable with Direct colours) is required. It is especially resorted to for producing fast shades with Alizarine Blue on an Oil-Tannin-Chrome mordant, also for Olive shades obtained with Ceruleine alone, or in combination with Alizarine Yellow GG and Alizarine Orange N, which are remarkably fast to boiling. Further, the Alizarine Red brands, alone or mixed with Alizarine Claret, produce fast Claret shades on a Chrome mordant, and finally Browns and Greens are obtained with Alizarine Brown and Alizarine Green S perfectly fast to washing.

The affinity of Chrome mordants for cotton is not so strongly marked as that of the Alumina and Iron mordants. The most useful Chrome salts for this purpose are Chromium Chloride and Chromium Chromate which have been put on the market as

Chrome Mordant GAI and Chrome Mordant GAI.

Chrome Mordant GAI contains Chromic Oxide, Chromic acid and Muriatic acid. Chrome Mordant GAI contains Chromic Oxide, Chromic acid and Acetic acid. By steeping the yarn in these mordants a large amount of Chromic Oxide is fixed on to the fibre. For the production of deep shades, the material is bottomed with Oil and Tannin, then mordanted, dried or steamed. In the latter case Chrome Mordant GAI (which contains Acetic acid and therefore is not injurious to the fibre) is used.

APPLICATION OF CHROME MORDANT IN YARN DYEING.

Directions for dyeing 250 lbs. of yarn.

Method A.

1. Boiling. The raw yarn is boiled with $7\frac{1}{2}$ lbs. of Soda and then washed.

2. Mordanting. The hydroextracted yarn is worked cold in Chrome Mordant GAI 19° Tw. for $\frac{1}{2}$ an hour, then steeped in this mordant for 12 hours, and hydroextracted. The liquid can be used over again if properly replenished.

3. Fixing. The mordanted and hydroextracted yarn is fixed with 2% Soda (20 parts Solvay Soda per 1000 parts water) at 122° F. for $\frac{3}{4}$ of an hour, and then well washed.

4. Dyeing. The dyebath contains $37\frac{1}{2}$ lbs. Dyestuff (paste), which is previously dissolved in 13 pints Ammonia 25%, $12\frac{1}{2}$ gall. Water and 6 ozs. Tannin. The yarn is worked in the cold bath for $\frac{1}{4}$ of an hour, then $3\frac{1}{4}$ galls Acetic acid 12° Tw. are added and the yarn worked for another $\frac{1}{4}$ of an hour, then the temperature is slowly raised to the boil within 1 hour and the dyeing operation continued at the boil for $\frac{1}{2}$ an hour. If calcareous water is used, the Carbonate of Lime must be converted into Acetate of Lime with Acetic acid.

For Alizarine Blue, however, water which is free from lime must be employed. In this instance the dyebath contains:

$37\frac{1}{2}$ lbs. Alizarine Blue paste,
7 gals. Acetic acid 12° Tw.,
 $4\frac{1}{4}$ gal. Ammonia 25%.

5. Soaping. The dyed and washed yarn is soaped with 12—25 lbs. of Soap at the boil for $\frac{1}{2}$ an hour.

Method B.

1. Boiling. The raw yarn is boiled with $7\frac{1}{2}$ lbs. Soda and then washed and hydroextracted.

2. Oiling. The boiled and hydroextracted yarn is oiled with a solution of 1 lb. Red oil 50% per gallon liquid, and then slowly dried at 150° F. within 12 hours.

3 Mordanting. The dried yarn is first worked cold in Chrome Mordant GAI 19° Tw. for $\frac{1}{2}$ an hour and then steeped in this mordant for 12 hours; after hydroextracting, the yarn is treated as stated under Method A.

Method C.

(For dark shades, especially Claret Reds.)

The yarn which is boiled, washed and hydroextracted as described under Method A, is treated in a bath containing the 15 fold amount of water (compared with the weight of the yarn) and $\frac{5}{8}$ oz. Tannin or $4\frac{1}{2}$ ozs. Sumach extract 20% per gallon of liquid; the yarn is worked at 176° F. for $\frac{1}{2}$ an hour, then the steam is turned off, and the yarn left in the bath for about 12 hours. After hydroextracting the yarn is at first worked cold in Chrome Mordant GAI 19° Tw. for $\frac{1}{2}$ an hour, then steeped in this mordant for 12 hours, and finally hydroextracted. Then treated at 140° F. for $\frac{3}{4}$ hr. with $3\frac{1}{2}$ oz Soda per gallon of liquid and washed. The material is dyed and soaped as described under Method A.

Method C permits of topping with Basic colours either simultaneously or afterwards.

Method D.

Directions for producing dark blues on yarn fast to bleaching.

1. Boiling. 100 lbs. raw cotton are boiled with 3 lbs. Solvay Soda under pressure of 2 atm. for 3 hours and then thoroughly washed.

2. Oiling. The boiled, washed and hydroextracted yarn is oiled in a solution of 15—19 oz. Sodium Turkey Red oil 50% per gallon liquid, then wrung evenly and dried at 150° F. for 12 hours.

3. Treatment with Tannin. The oiled and dried yarn is worked in a warm Tannin solution at 176° F. for $\frac{3}{4}$ of an hour and then steeped in this bath for 12 hours and hydroextracted. The Tannin solution is made up with the 10—15 fold amount of water (compared with the weight of the yarn) and contains 1 oz. of Tannin per gallon of liquid.

4. Chrome Mordant. The tannated and hydroextracted yarn is worked cold in a solution of Chloride of Chrome 19° Tw. for 1 hour, and then steeped in this bath for 12 hours. After hydroextracting, the yarn is washed (preferably in running water).

Both the Chloride of Chrome solution and the Tannin mordant may be used again if properly replenished.

5 Dyeing. For dyeing, water free from lime must be employed; water of $2\frac{1}{2}$ ° hardness is permissible, but the Carbonate of Lime must be converted into Acetate by using Acetic acid. Very calcareous water must be freed from Lime before use. The dyebath contains per 100 lbs. of yarn:

15 lbs Alizarine Blue F paste,
2 gall. 7 pts. Acetic acid 12° Tw.,
1 gall. $5\frac{1}{2}$ pts. Ammonia 25%,
 $2\frac{1}{2}$ ozs. Tannin,

or
5 lbs. Alizarine Blue SB powder,
5 „ Acetic acid 12° Tw.,
 $2\frac{1}{2}$ ozs. Tannin.

The yarn is worked cold for $\frac{1}{4}$ of an hour, then the bath is slowly heated to the boil within 1 hour and the yarn worked at the boil for $\frac{1}{4}$ of an hour. Finally it is washed and hydroextracted.

6. Steaming. The dyed and washed yarn is steamed under pressure of $1-1\frac{1}{2}$ atm. for 2 hours.

7. Soaping. After steaming the yarn is soaped at the boil for $\frac{1}{2}$ an hour, either in an open or in closed vessel. According to the nature of the water $\frac{1}{2}$ —1 oz. Soap per gallon of water is required.

The following colours are suitable for application on a Chrome mordant:

| | |
|------------------------------|----------------------------------|
| Alizarine Red, all brands, | Alizarine Green S paste, |
| Alizarine Claret R paste, | Galleine, all brands, |
| Alizarine Orange, | Alizarine Blue, all brands, |
| Alizarine Yellow 5G, GG, R, | Anthiol Blue NR paste, NG paste, |
| Alizarine Brown, all brands, | Philochromine B and G paste, |
| Ceruleine S, SW, A, | Chrome Violet, all brands. |

B. Dyeing of piece goods.

TURKEY RED ON PIECE GOODS.

1. Oiling. The oil bath contains 1 gall. of Turkey Red oil 50% (which is neutralised with Ammonia) and 4 gall. of water (free from lime). The pieces are passed through the bath once or twice, then dried, and steamed if necessary for 1 hour under pressure of $\frac{1}{2}$ atm.

2. Mordanting. The material is mordanted with Acetate of Alumina 7,2° Tw. (as described under New Red for yarn).

3. Fixing. The fixing bath contains $1\frac{1}{2}$ —2 ozs. Chalk or 1 oz. Sodium Phosphate per gallon liquid; the pieces are worked in this bath at 113° F. for $\frac{1}{2}$ an hour and then well washed.

4. Dyeing. The pieces are dyed cold in the 20 fold amount of water (which is corrected according to its degree of hardness) with

| | |
|------|----------------------------|
| 10 | % Alizarine paste 20°/o, |
| 1,5 | % Acetate of Lime 29° Tw., |
| 0,15 | % Tannin |

for $\frac{1}{4}$ of an hour; the temperature is then raised to 190° F. within $\frac{3}{4}$ hr., and the dyeing operation continued at this temperature for $\frac{1}{2}$ an hour; finally the pieces are washed.

5. Oiling. The pieces are passed through a solution of 1 gallon Turkey Red oil 50% in 9 gallons water (free from lime), then dried, and steamed for 2 hours under pressure of $1\frac{1}{2}$ atm.

6. Soaping. Finally the pieces are worked in a bath containing 1 oz. Soap per 3 gallons water at 140° F. for 20 minutes, then washed and dried.

Pink on piece goods is generally produced according to the so called Erban-Specht method.

To produce a **Claret Red** upon piece goods the latter are mordanted in the same manner as for "Red" and then dyed with Alizarine Claret R by itself or in combination with Alizarine Red. In order to obtain full and dark brownish Claret Reds with as little dyestuff as possible, the addition of some Alizarine Brown is advisable.

ALIZARINE ONE BATH COLOURS.

In certain cases, especially for light shades and for those colours which require no Lime, the Alkaline mordants may be added to the bath (in piece dyeing) so that the goods are only passed once through the padding liquid and are then steamed. In this case the shades may be brightened with suitable wool colours and Eosines, which can be fixed by means of Chrome

| | |
|--|---|
| 3 $\frac{1}{8}$ ozs. Alizarine Claret R, | Alkaline Chrome Mordant. |
| 7 quarts Water, | 12 $\frac{1}{2}$ gills Ammonia, |
| 3 $\frac{1}{8}$ gills Ammonia 1:10, | 4 $\frac{1}{4}$ pints Water, |
| 1 $\frac{1}{4}$ „ Acetate of Soda 1:10, | 8 $\frac{1}{2}$ gills Glycerine, |
| 8 ozs. Chrome Mordant, | 6 $\frac{1}{4}$ pints sextuple Acetate of |
| 2 gall. | Chrome 32,4° Tw., |
| | 2 gall. |

ALIZARINE BLUE ON COTTON CLOTH.

The bleached material is oiled on the padding machine with Turkey Red oil 50% (1 $\frac{3}{8}$ pints per gallon), dried in the hot flue, mordanted with Chrome Mordant GA II 12° Tw. with an addition of Glycerine (5 ozs. per gallon), and then dried. The mordanted material is passed through an ager for 3 minutes at 210–212° F.; it is then fixed first at full width for 1 min. at 140° F. in a bath containing 5 ozs. Soda per gallon water, and then worked in rope form for 20 min. in a cistern containing 1 oz. Soda per gallon at 140° F. Finally it is washed and dyed in the 30 fold amount of dye liquor. The dye-bath contains the dyestuff and a small quantity (1 part in 2000) of Acetic acid 50%. The goods are first worked cold for $\frac{1}{2}$ an hour, then the bath is heated to the boil in $\frac{1}{2}$ an hour, and the material boiled for another $\frac{1}{2}$ hour. Finally it is washed and soaped (2–1000) for $\frac{1}{4}$ hour at 176° F.

TURKEY RED OIL.

Turkey Red oil is obtained by treating Castor oil with concentrated Sulphuric acid; any excess of acid is removed by washing and neutralising with Ammonia or Caustic Soda. Turkey Red oil is soluble in water and reacts slightly alkaline. 50 lbs. of the best Castor oil are slowly mixed with 12 $\frac{1}{2}$ lbs. Sulphuric acid 168° Tw., care must be taken lest the temperature rises above 90° F. The mixture is allowed to stand for 24 hours; then 10 gallons of warm water are added, the whole well stirred and allowed to stand for 48 hours. The water is then drawn off and the oil neutralised with 1 $\frac{1}{4}$ gallons of Ammonia 25%.

The whole is made up to 10 gallons with water. Ammonia Turkey Red oil is thus obtained containing 50% Castor oil.

In order to obtain the corresponding Sodium salt, the oil is neutralised with 30 lbs. of Caustic Soda 34° Tw. (free from Iron) instead of Ammonia, and made up to 10 gallons with water. Pure water (free from lime) must be employed in the manufacture of Turkey Red oil.

TABLE FOR CORRECTING THE WATER,

showing the requisite amounts of Acetate of Lime and Acetic acid in dyeing Alizarine Red shades, calculated for 100 litres of water according to its degree of hardness.

| Degree of hardness | Acetate of Lime 28° Tw. | Acetic acid 12° Tw. |
|--------------------|-------------------------|---------------------|
| 1 . . . 1,25 | . . . 65,4 cc | |
| 2 . . . 2,5 | . . . 56,3 ,, | |
| 3 . . . 3,75 | . . . 47,2 ,, | |
| 4 . . . 5 | . . . 38,1 ,, | |
| 5 . . . 6,25 | . . . 27,2 ,, | |
| 6 . . . 7,5 | . . . 20,0 ,, | |
| 7 . . . 8,75 | . . . 10,9 | . . . 4,5 cc |
| 8 . . . 10 | . . . 1,8 | . . . 9,0 ,, |
| 9 . . . 11,25 | | . . . 13,5 ,, |
| 10 . . . 12,50 | | . . . 18,0 ,, |
| 11 . . . 13,75 | | . . . 22,5 ,, |
| 12 . . . 15 | | . . . 27,0 ,, |
| 13 . . . 16,25 | | . . . 31,5 ,, |
| 14 . . . 17,50 | | . . . 36,0 ,, |
| 15 . . . 18,75 | | . . . 40,5 ,, |
| 16 . . . 20 | | . . . 45,0 ,, |
| 17 . . . 21,25 | | . . . 49,5 ,, |
| 18 . . . 22,50 | | . . . 54,0 ,, |
| 19 . . . 23,75 | | . . . 59,5 ,, |
| 20 . . . 25 | | . . . 64,0 ,, |

VI. DYEING WITH RESORCINE AND AZO COLOURS.

A.

The solutions of Resorcine colours, contrary to those of the Azo colours, show considerable fluorescence.

The Resorcine colours are dyed with a large addition of Common salt:

The dyebath is prepared with 5—10 ozs. Common salt per gallon and the necessary amounts of dyestuff, and the cotton worked at 86° F. for $\frac{1}{2}$ to $\frac{3}{4}$ of an hour. After dyeing, the material is wrung and dried. Old baths are replenished and then used again. The fastness to water is considerably increased by an after-treatment with Solidogen A.

The developing bath is prepared with 2% Muriatic acid, 2—6% Solidogen A and 8—12 ozs. Common salt per gallon liquid.

The dyed and rinsed material is entered and worked at 170° F. for $\frac{1}{2}$ hour and then thoroughly rinsed.

If copper vessels are used 5—10 parts Sulpho-Cyanide of Ammonia per 1000 parts of water must be added to the bath before the other ingredients are added.

Eosine, all brands,
Erythrosine, all brands.
Phloxine, all brands,
Rose Bengale, all brands,

are dyed according to this method.

B.

The Azo colours, of which

Brilliant Orange G

Brilliant Croceine R, B, 5B, blue shade and

yellow shade are principally used, are dyed with Alum and Common salt. The cotton is dyed in a concentrated bath containing 10% Alum and 40% Common salt at 100—120° F. The material is not rinsed after dyeing, but wrung and then dried. Old baths can be used again if properly replenished.

VII. DYEING WITH COLOURS PRODUCED ON THE FIBRE BY A PROCESS OF OXIDATION.

A. Aniline Black.

Three methods of producing Aniline Black must be distinguished:

1. One bath Black (Dye Black),
2. Oxidation Black,
3. Steam Black.

1. ONE BATH (DYE-) BLACK.

The dyebath is prepared with:

- 10% Aniline salt,
- 14% Muriatic acid 36° Tw.,
- 3 $\frac{1}{2}$ % Sulphuric acid 168° Tw. When cool, a solution of
- 13% Sodium Bichromate is added.

The goods are entered and worked cold for $\frac{1}{2}$ an hour: the bath is brought to the boil in another $\frac{1}{2}$ hour, and the goods then worked for $\frac{1}{4}$ of an hour. They are then well rinsed and soaped at the boil; 1% Logwood extract may be added to the soap bath. — In order to increase the fastness to rubbing, the material is frequently dyed with about 2% Dianil Black CR, or with Thiogene Black, and topped with Aniline Black; the dye liquid is made up to one half or one quarter of the above strength.

2. OXIDATION BLACK.

Loose cotton and yarn are dyed with a mixture of:

| | | |
|--------------------|-------|---------------------------------------|
| 126 | parts | Aniline Salt, |
| 40 | „ | Sodium Chlorate, |
| 5 | „ | Chloride of Ammonia, |
| 3 | „ | Copper Sulphate, |
| 120 | „ | Acetate of Alumina 22° Tw. are added. |
| Make up to 12° Tw. | | |

The well wetted cotton is impregnated with this solution, and then hydroextracted (The extracted liquid is always returned to the bath for the next lot.) The material is dried at 90–110° F. To ensure a rapid and even oxidation, it is necessary to shake up the cotton before and during the drying operation. The process of drying lasts 18–24 hours; then the Black developed in a bath (100–120° F.) containing:

| | |
|------|-------------------------|
| 6% | Bichrome (Sodium Salt), |
| 0.5% | Aniline Salt, and |
| 2% | Sulphuric acid 168° Tw. |

The black cotton is finally well washed and the shade brightened with an oil emulsion.

For piece goods the following proportions may serve as a guide:

| | | | |
|-----|-------|------------------------------|-----------------|
| 120 | parts | Aniline Salt (Hydrochloride) | } in 1000 water |
| 10 | „ | Aniline Oil | |
| 35 | „ | Sodium Chlorate | |
| 0.5 | „ | Copper Sulphate | |

After passing through the Oxidation box the material is chromed.

Directions for an ungreenable Aniline Oxidation black.

Two baths are prepared:

| Standard A. | | Standard B. | |
|--------------------|------------------------|-----------------------|------------------------|
| 11 gall. | 55 lit. Water | 3 $\frac{3}{4}$ lbs. | 1850 g Nitrate of Iron |
| 9 lbs. | 4500 g Aniline Salt | | 76° Tw. |
| 23 $\frac{1}{4}$ „ | 1350 g Toluidine | 1 $\frac{1}{4}$ gall. | 6 lit. Water |
| 11 $\frac{1}{2}$ „ | 700 g Acetic acid | 5 $\frac{1}{2}$ lbs. | 2700 g Carbon Sulphate |
| 3 $\frac{3}{4}$ „ | 1850 g Sodium Chlorate | | solution 20:100 |

8 parts of Standard A. are mixed with 1 part of Standard B for the padding liquid. The material is then treated as described above.

3. STEAM BLACK.

The bleached and boiled cloth is padded on the padding machine, dried in the hot flue, and steamed for 2 minutes in the Mather Platt; it is then passed through a Chrome bath (5:1000 solution of Bichrome) for 1—1½ minutes at 120° F., washed and dried. The chrome bath, to which some soda is added, may be replaced by a sodium silicate bath.

Padding liquid for Steam Black (Prud'homme Black).

| | | | |
|--------------|------|--------|----------------------|
| 3 lbs. 6 | ozs. | 84 g | Aniline Salt |
| 1 lb. 10 | ozs. | 40 g | Tragacanth (60:1000) |
| | 3 ½ | 5 g | Aniline Oil |
| | 1 | 220 cc | Water |
| 2 lbs. 4 | ozs. | 54 g | Yellow Prussiate |
| | 1 | 280 cc | Water |
| 1 lb. 5 | ozs. | 30 g | Sodium Chlorate |
| | 5 | 320 cc | Water |
| make up to 4 | | gali. | 1 litre. |

B. Diphenyl Black.

Whilst even the very best Aniline Blacks have the tendency to turn green, whereby the fibre is apt to be tendered, Diphenyl Black, which was discovered in 1902 by the Farbwerke Hoechst, is an absolutely unchangeable black, which leaves the fibre perfectly unimpaired.

This black can be produced with either Diphenyl Black Base I or with Diphenyl Black Oil DO.

Diphenyl Black Base is oxidised by means of Chlorates and oxygen carriers such as Copper Chloride, Copper Nitrate, Alumina Chloride, Cerochloride, Pyrolignite of Iron, Vanadium salts etc.

Yellow and Red Prussiates and Sulphates cannot be used because the corresponding salts of the Diphenyl Black Base are very insoluble.

The addition of Gum Tragacanth to the padding liquid is necessary in order to prevent the Acetate of the Diphenyl Black Base from dissociating.

Directions for yarn dyeing.

Preparation of the Padding liquids:

Standard A.

| | | | |
|--------|-------|---------|---|
| 10 | oz. | 350 g | Diphenyl Black Base I are dissolved by heating with |
| 2 | pints | 1500 cc | Acetic acid 9° Tw., and |
| 1/2 | „ | 400 cc | Lactic acid 50°/o. The solution is cooled and then stirred into |
| 28 1/2 | oz. | 1000 g | Tragacanth (60:1000) and |
| 2,6 | pints | 2000 cc | Water |
| 9 | lbs. | | |

Standard B.

| | |
|---------|--------------------------------------|
| 1 gill. | 170 cc Alumina Chloride 52° Tw., and |
| 0.56 „ | 100 cc Cerochloride are diluted with |
| 6 pints | 3850 cc Water, and |
| 7 oz. | 250 g Sodium Chlorate dissolved in |
| 1 pint | 750 cc Water |
| 9 lbs. | |

4 pints of Standard Solution A and 4 pints of Standard Solution B are poured into a round vessel (tureen), such as is used for dyeing Aniline Oxidation Black and Azophor Red. The yarn is passed through in lots of about 2 lbs.; it need not be boiled previously, as the solution wets it very readily. After wringing or hydroextracting, the waste liquid is poured back into the tureen, and for the next 2 lbs. of yarn the liquid is refreshed with $2\frac{2}{3}$ gills Standard Solution A and $2\frac{2}{3}$ gills Standard Solution B.

After wringing, the yarn is put on sticks and dried at about 140° F. It is particularly important that the yarn be evenly dried. Finally it is steamed for 5–10 minutes without pressure, washed, and slightly soaped.

Directions for dyeing piece goods.

Two Stock solutions are prepared. A. & B. Of these only as much is mixed at a time as will fill a small furnishing box. The mixture of both solutions is only stable for a few hours.

Diphenyl Black has the advantage that raw unboiled material can be padded with it. The padded goods are dried in the hot flue, and then steamed for 2–10 minutes in the Mather-Platt. Diphenyl Black Oil DO yields bluer and fuller blacks than Diphenyl Black Base I. Very thin material such as Battiste, Organdi (Cambric) etc. is best worked with Diphenyl Black Base I, as this does not impair the fibre in the slightest. Afterchroming cannot only be dispensed with, but is actually detrimental to the shade. In order to cheapen the black, part of the Diphenyl Black Base can be substituted by Aniline, as given under B.

After steaming, the padded goods are immediately washed and soaped. A soap bath increases the brilliancy of the black.

A. Black prepared with Diphenyl Black Base I.

| | | | |
|------------|---|------------|---|
| Standard A | { | 600 parts | Tragacanth water 1 : 10 are diluted with |
| | | 750 " | Water |
| | | 400 " | Diphenyl Black Base I are dissolved with |
| | | 500 " | Lactic acid 50% and |
| | | 1300 " | Acetic acid 40% by warming and stirred into the Tragacanth, and the whole |
| made up to | | 5000 parts | with water. |

| | | | | |
|------------|---|---|-----------|---------------------------------|
| Standard B | { | { | 250 parts | Alumina Chloride 52° Tw. |
| | | { | 250 | „ Chromium Chloride 52° Tw. |
| | | { | 40 | „ Copper Chloride 76° Tw. |
| | | { | 3460 | „ Water are mixed with |
| | | { | 300 | „ Sodium Chlorate, dissolved in |
| | | { | 600 | „ Hot Water and |
| | | { | 100 | „ Turpentine. |
| | | | <hr/> | 5000 parts |
| | | | <hr/> | 10000 parts. |

B. Black prepared with Diphenyl Black Base I and Aniline.

| | | | | |
|------------|---|---------------------|------------|------------------------------|
| A | { | { | 1000 parts | Tragacanth water 60 : 1000 |
| | | | 1000 " | Water |
| | | | 300 " | Diphenyl Black Base I |
| | | | 1350 " | Acetic acid 9° Tw. |
| | | | 125 " | Pyrolignite of Iron 53° Tw |
| B | { | | 150 parts | Aniline Salt |
| | | | 115 " | Copper Nitrate 30° Tw. |
| | | | 100 " | Vanadate of Ammonia 1 : 1000 |
| | | | 3500 " | Water |
| C | { | | 300 parts | Sodium Chlorate |
| | | | 600 " | Water. |
| make up to | | <u>10000 parts.</u> | | |

C. Diphenyl Black Oil DO.

| | | | |
|------------|---|----------------|--|
| Standard A | { | 600 parts | Tragacanth water 1 : 10 are diluted with |
| | | 750 " | Water |
| | | 600 " | Diphenyl Black Oil DO, dissolved cold in |
| | | 1500 " | Acetic acid 40% are stirred into the |
| | | Tragacanth and | |
| made up to | | 5000 parts | with water. |

| | | | |
|------------|---|-------------|---------------------------|
| Standard B | { | 3070 parts | Water |
| | | 380 " | Muriatic acid 30° Tw. |
| | | 180 " | Alumina Chloride 52° Tw. |
| | | 250 " | Chromium Chloride 52° Tw. |
| | | 40 " | Copper Chloride 76° Tw. |
| | | 100 " | Turpentine. |
| | | <hr/> | |
| | | 4000 parts. | |

| | | |
|--------------|--------------|-----------------|
| Standard C { | 300 parts | Sodium Chlorate |
| | 700 ,, | Water |
| | <hr/> | |
| | 1000 parts. | |
| | <hr/> | |
| | 10000 parts. | |

Before use B and C are added to A.

Reducing Paste.

| | |
|-------------------|---------------------------------|
| 300 parts | thin Tiagacanth water (20:1000) |
| 155 ., | Acetic acid 9° Tw. |
| 550 ., | Water |
| <hr/> 1000 parts. | |

The boiled raw material is padded 2—4 times on the padding machine (increase of weight about 100 %).

After padding the goods are passed through the hot flue at 120—140° F. (dry thermometer) and 40—50° hygrometer Binda for about $\frac{1}{8}$ an hour. The Diphenyl Black is developed by steaming for 2 minutes at 212° F. in the Mather Platt. Satisfactory results are also obtained by drying the goods after padding for 15 minutes at 140° F. and then steaming them for 10 minutes at about 200° F.

The padded pieces are not chromed but washed and soaped at 140° F. If it is necessary to produce a greenish black, similar to Aniline Black, some Fustic extract is added to the soap bath, and the goods worked in it for 10 minutes at 170—212° F. After soaping, the material is well rinsed first in condensed water and then in ordinary water.

VIII. NITROSO BLUE, NITROSO BROWN AND NITROSO GREEN.

Full details about the application of these dyes are given in the chapter on Calico Printing.

IX. PRODUCTION OF INSOLUBLE AZO-COLOURS ON THE FIBRE.**I. Yarn Dyeing.****A. PARANITRANILINE RED.**

The Insoluble Azo Colours can be employed in yarn dyeing for various purposes.

1. For open warps; 2. for warps which are passed through the machine in rope form; 3. for yarn in the hank

The yarn is boiled for several hours with 2—3% of Soda, Caustic Soda or Silicate of Soda, then rinsed and dried. (It is not advisable to work with hydroextracted or wet yarn, because this would alter the concentration of the prepare and cause unevenness and alteration of depth of colour.) A brighter and clearer red is obtained on bleached yarn, or on yarn passed through a weak chlorine solution after dyeing.

The grounding with Naphtol solution is carried out warm or hot, the yarn thus being more quickly and more evenly wetted.

For the production of small quantities, it is advisable to use a tureen.

About 3 gallons of Naphtol-solution suffice for preparing; 4—5 gallons of liquid, however, will be needed for the developing bath.

A squeezing appliance is generally attached to the tub.

The yarn is passed, about 2 lbs. at a time, once or twice through the liquor, wrung out very evenly or hydroextracted; the preparing liquor is then replenished (with 750 cc. for each lot) and may be used again.

For large production, tramping-machines with small liquor troughs are employed.

Preparing.

The prepare contains:

| | |
|---------------------------|--------------------------------------|
| 1 lb. | { 25 g Beta-Naphtol |
| for yellowish red 5 gills | { 40 cc Caustic Soda 33° Tw. |
| 7—9 „ | { 60—75 cc Sodium Turkey Red Oil 50% |
| 1 lb. | { 25 g Beta Naphtol R |
| for blueish reds 6 gills | { 50 cc Caustic Soda 36° Tw. |
| 7—9 „ | { 60—75 cc Sodium Turkey Red Oil 50% |
| per 4 gallons | 1 litre liquid. |

It is advisable to increase the amount of Oil (up to $\frac{3}{4}$ pint per gallon) for fine yarns.

The prepared yarn ought to be dried as quickly as possible. The temperature should not rise above 120—140° F. In drying, the yarn must be protected from direct sunlight, and from acid and chlorine vapours. After drying, it is best to develop it immediately.

I. PARANITRANILINE DEVELOPING BATH.

As the finely ground Paranitraniline is very voluminous and holds a considerable amount of air, it does not wet readily, and therefore the crystallised product is preferable in most cases. This dissolves easily in Hydrochloric acid. If, however, the dyer wishes to prepare the nitrite paste, he will prefer the Paranitraniline in finely ground powder form.

There are two methods of using Paranitraniline :

1. the 25% Nitrite paste (which may be prepared by mixing or grinding the Paranitraniline powder with the necessary amount of Nitrite solution) is slowly stirred into the cold mixture of Hydrochloric or Sulphuric acid, Ice and Water ;

2. the above mentioned Paranitranilines are dissolved as Hydrochlorides or Sulphates, and the Sodium Nitrite solution is then added cold.

The necessary amount of Paranitraniline is dissolved in boiling water with the addition of the requisite amount of acid, using for 1 molecule of Paranitraniline 2,2—2,5 mol. HCl or 1,1—1,25 H₂SO₄; the solution is stirred until cold, ice being added whilst stirring continually. The salt which is formed, separates as a very fine crystalline powder. On adding the Nitrite solution to the mixture, complete diazotation takes place.

The developing baths of Paranitraniline are prepared :

a) As Nitrite paste.

| | | |
|--------------|------------|---|
| 1 lb. 2 ozs. | 280 g | Paranitraniline extra are made into a paste with |
| 2½ gills | 200 cc | Cold Water, then cooled and |
| 6½ gills | 520 cc | Sodium Nitrite solution (3 lbs. per gall.) (290 g i./L.) added. |
| | | Whilst stirring continuously the whole is gradually mixed with |
| 5½ gills | 440 cc | Muriatic acid 36° Tw. and |
| 12 pints | 4000 cc | Ice Water and Ice. — After stirring, the solution is filtered, and before use |
| 2½ lbs. | 600 g | Sodium Acetate added, and the whole made up to |
| 4 gallons | 10 litres. | |

b) By Dissolving in Acid.

| | | |
|--------------|------------|--|
| 1 lb. 2 ozs. | 280 g | Paranitraniline extra are dissolved in |
| 2 quarts | 1200 cc | Boiling Water and |
| 5½ gills | 440 cc | Muriatic acid 36° Tw.; whilst cooling and stirring the Paranitraniline is precipitated in very fine particles; then are added: |
| 3 pints | 1000 cc | Cold Water and |
| 4 lbs. | 1000 g | Ice, and at 32—36° F. add |
| 6½ gills | 520 cc | Sodium Nitrite Solution (3 lbs. per gall.) (290 g i./L.). — After stirring, the solution is filtered; before use |
| 2½ lbs. | 600 g | Sodium Acetate added, and diluted with water to |
| 4 gallons | 10 litres. | |

2. AZOPHOR RED PN DEVELOPING BATH.

This process possesses the following advantages over Paranitriline:

- a) The diazotation is no longer necessary.
- b) The Ice, so necessary for diazotising Paranitriline and cooling the bath, is not required for Azophor Red; the latter needs only to be dissolved in cold water.
- c) The Azophor Reds, compared with Paranitriline Red, have more body, and give the fibre a better handle.

The Azophor Red is dissolved in a barrel, provided with a tap a little above the bottom by which the clear solution can be let off.

About 10 lbs. (4500–5600 g) of Azophor Red are stirred in a barrel with 6 gallons (30 litres) cold water until dissolved, which takes $\frac{1}{4}$ – $\frac{1}{2}$ an hour at the most; then the solution is allowed to stand for 1–2 hours; a small quantity of a very voluminous, frothy matter ($\frac{1}{2}$ –1% of the weight of Azophor Red) collects at the top of the solution.

The clear solution is then drawn off or the whole filtered through calico. The residue left in the barrel or on the filter is washed with 2 gallons (10 liter) of cold water. 8 gallons (40 liter) of Solution A are thus obtained

For neutralising the Azophor Red solution, Caustic Soda is used instead of the more expensive Acetate of Soda. This yields not only a cheaper but also a bluer red. Concentrated Soda lye must not be employed, it is advisable to dilute

| | |
|-----------|--------------------------------------|
| 6–8 pints | 2–2½ litre Caustic Soda 36° Tw. with |
| 26–24 .. | 8–7½ .., Water, yielding |
| 4 gallons | 10 litres Solution B. |

Before use 2 gallons solution B are added, whilst stirring continuously, to 8 gallons of solution A; at first a flocculent substance is formed which, however, is gradually and entirely dissolved again. Solution A can be kept without ice for several days as long as solution B has not been added.

The developing must take place in a bath which is not too dilute. The best results are obtained by using a very concentrated solution; it is, however, more economical to work in a weaker bath. A concentration of

| |
|--|
| 9½ ozs. per gall. (56 g i./L.) of Azophor Red or |
| 2½ .., (14 g) Paranitriline |

produces very good results, when working on a large scale. A suitable vessel, about 4 gallons is half filled with equal parts of Azophor Red solution and water. The yarn (2 lbs. at a time), which must not be held too tightly by the workman, is entered quickly into the dye bath. The yarn is worked for some time and then wrung. Each time as much of neutralised Azophor Red solution is added to the bath, as has been absorbed by the yarn, about 5 gills (750 cc). The yarn is allowed to lie for some time after developing, in order to complete the coupling, then it is thoroughly rinsed with cold water.

soaped at 140° F. for 10–15 min. with $\frac{1}{3}$ oz. Soap per gall. of water for yellow shades, and with $\frac{1}{3}$ oz. (20 g) of soap and 16 grains ($2\frac{1}{2}$ g) soda per gallon (10 liter) water for blue shades, then well washed and dried at not too high a temperature. In order to give the yarn a blueish shade overhand, it can be topped with Rosazeme, the latter being fixed by the oil contained in the prepare.

Directions for dyeing 400 lbs. of yarn.

1. Prepare.

- | | | | |
|-----|----------------------|---|--------------------------------|
| I. | 8 lbs. | { | 3 k 900 g Beta Naphtol R |
| | 8 gall. | | 40 litre Boiling Water |
| | $15\frac{3}{4}$ lbs. | | 7 k 860 g Caustic Soda 36° Tw. |
| II. | $21\frac{1}{2}$ gall | { | 108 litre Warm Water |
| | 28 lbs. | | 14 k Soda Turkey Red oil 50° |

(Solution II must be clear otherwise a further addition (up to 1 quart) of Caustic soda lye 36° Tw. must be made.)

Add I to II.

2. Developing Bath.

a) Azophor Red.

| | | |
|-----------------------|------------|---|
| 33 $\frac{1}{2}$ lbs. | 16800 g | Azophor Red PN are made into a smooth paste with |
| 20 gall. | 100 l | Cold Water; after standing for several hours, the clear liquid is drawn off: the residue is washed with |
| 7 gall. | 35 l | Water, and the clear solution again drawn off. Then |
| 17 $\frac{3}{4}$ lbs | 8900 g | Caustic Soda 36° Tw diluted with |
| 5 gall. | 26 l | Water are added. The whole is made up to |
| 32 gall. | 160 litres | |

b) Para Red.

| | | | |
|--------------|-----------------------|------------|--|
| Solution I. | 8 $\frac{1}{2}$ lbs. | 4200 g | Paranitraniline extra are dissolved in |
| | 7 gall. | 36 l | Boiling Water and |
| | 13 $\frac{1}{4}$ lbs. | 6600 g | Muriatic Acid 36° Tw.; whilst cooling and stirring, the Paranitraniline is precipitated in very fine particles: then are added |
| | 60 lbs. | 30 k | Ice, and at 32–36° F. |
| | 1 $\frac{3}{8}$ gall. | 7800 cc | Sodium Nitrite Solution (3 lbs. per gall.) (290 g per litre). After stirring and filtering, the whole is made up to |
| | 24 gall | 120 litres | with water. |
| Solution II. | 18 lbs. | 9000 g | Sodium Acetate are dissolved in |
| | 6 gall. | 30 l | Cold Water, and made up to |
| | 8 gall. | 40 litres. | |

3 parts of Solution I are mixed with 1 part of Solution II. Sometimes Solution II is replaced by Solution III, which is even somewhat more economical on account of the smaller amount of Sodium Acetate.

| | | | |
|------------------|---|---------|------------------------------------|
| Solution III. | { | 9½ lbs. | 4800 g Sodium Acetate and |
| | | 3¼ lbs | 1600 g Calc. Soda are dissolved in |
| | | 6 gall | 30 l Water, and made up to |
| | | 8 gall | 40 litres. |

B. ALPHA NAPHTHYLAMINE CLARET

The production of Alpha Naphtylamine Claret on yarn is surrounded with difficulties, primarily due to the great instability of the diazo- α -naphthylamine.

Directions for dyeing 400 lbs. of yarn.

The Preparing Bath.

The yarn is boiled with 3% Soda, washed and dried; then, in 2 lb. lots, passed through the Naphtol solution and wrung evenly.

Each time after passing a 2 lb. lot through the bath, 5 gills (750 cc) fresh solution are added to the latter. The solution consists of:

| | |
|--------------------|--|
| 8½ lbs. | 4250 g Beta Naphtol |
| 1¾ gall. | 8500 cc Caustic Soda 36° Tw. |
| 25½ lbs. | 12750 g Tragacanth (60:1000) (10 ozs per gall.) (60 g per litre) |
| made up to 34 gall | 170 litres |

The yarn is passed through the solution a second time, then hydroextracted and dried.

The Developing Bath

This is prepared as follows:

| | | | |
|-----------------|---|-----------|--|
| Solution I. | { | 12¾ lbs. | 6400 g Alpha Naphtylamine Salt S is made |
| | | 8 gall. | into a paste with |
| | | 6¾ lbs. | 40 l Cold Water and |
| | | 110 lbs. | 3340 g Sulphuric acid 168° Tw.; then |
| | | | 55 k Ice are added. The whole is well stirred |
| | | | and |
| Solution II. | { | 13½ pints | 8700 cc Sodium Nitrite solution (3 lbs. per gall) |
| | | | (290 g per L.) are slowly added at |
| | | | 32–36° F. After 15 min. it is filtered, |
| | { | 34 lbs. | 17 k Tragacanth (60:1000) (10 ozs. per gall.) |
| | | | (60 g per litre) added, and made up to |
| | | 26 gall. | 130 litres. |
| | { | 20 lbs. | 10 k Sodium Acetate are dissolved in water |
| | | | and the solution made up to |
| | | 9 gall. | 45 litres. |

Before use, 3 parts of solution I are mixed with 1 part of solution II.

Of this mixture $2\frac{1}{2}$ gallons ($12\frac{1}{2}$ l) and $2\frac{1}{2}$ lbs. (1200 g) Tragacanth (60:1000) (10 ozs. per gall.) (60 g per litre) are poured into the tureen and made up to 5 gallons (25 l) with cold water.

After the passage of each 2 lb. lot, the bath is replenished with about 5 gills (750 ccm.) of the mixture. The yarn is then immediately washed and dried at 140° F. When dried too hot, the beauty of the shade is impaired.

II. Dyeing of Cotton piece goods.

Directions for Red and Claret Red.

A. PARANITRANILINE RED.

The cloth is prepared with a solution:

| | |
|---------|--------------------------------------|
| 1 lb. | 250 g Beta Naphtol |
| 5 gills | 400 cc Caustic Soda 36° Tw. |
| 1 lb. | 250 g Para Soap PN made up to |
| 4 gall. | 10 litres with water. |

The machine which serves for developing the shade consists of (a) a padding-roller with colour-box; (b) a system of high-level guide rollers, which are intended to prolong the time of impregnation with the developing liquor, so as to ensure complete formation of the colour, and (c) of a system of roller-cisterns with perforated water pipes

The developing bath must be very concentrated, and must be continually replenished with the same amount of liquor as has been absorbed by the material.

The developing bath consists of:

| | |
|----------------------|---|
| $9\frac{1}{2}$ ozs. | 140 g Paranitraniline are dissolved in |
| $\frac{1}{2}$ gall. | 1200 cc Boiling Water and |
| 3 gills | 220 cc Muriatic acid 36° Tw. and cooled whilst stirring. |
| | The Paranitraniline precipitates in very fine particles: then |
| 4 lbs. | 1 k Ice, and at $32-36^{\circ}$ F. |
| $3\frac{1}{2}$ gills | 260 cc Sodium Nitrite solution (3 lbs. per gall.) (290 g per litre) are added. After stirring, the whole is filtered and before use, neutralised with |
| 1 lbs. 4 ozs. | 300 g Sodium Acetate, and made up to |
| 4 gall. | 10 litres. |

If the Naphtol prepare is dried sharply, the Para Red turns out slightly bluer: an addition of Soda to the Soap bath or of small amounts of Magnesium Chloride to the finish, produces a bluer shade.

B. ALPHA NAPHTYLAMINE CLARET.

When using Para Red it is advisable to add some oil to the prepare, in order to obtain fast and blueish reds; the shades of Alpha Naphthylamine Claret however, are turned brownish and bronzy by an addition of oil, whilst gum tragacanth enhances the beauty of the shade.

The developing bath can be prepared with Alpha Naphthylamine Base, with the Hydrochloride, or preferably with Alpha Naphthylamine Salt S, which sets well.

The cloth is prepared with:

| | |
|-------------|----------------------------|
| 1 lb. | 250 g Beta Naphtol |
| 6 1/4 gills | 500 cc Caustic Soda 36° Tw |
| 3 lbs. | 750 g Tragacanth (60:1000) |
| 4 gall. | 10 litres. |

and after drying, developed with one of the three following solutions:

1. With Alpha Naphthylamine Base.

| | |
|-------------|--|
| 9 1/2 ozs. | 143 g Alpha Naphthylamine Base are dissolved with |
| 5 qts. | 3 L Hot Water and |
| 1 1/2 gills | 100 cc Muriatic acid 36° Tw.; when cool |
| 2 2/3 gills | 200 cc Muriatic acid 36° Tw.; |
| 8 lbs. | 2 k Ice |
| 3 1/2 gills | 260 cc Sodium Nitrite solution (3 lbs. per gall.) (290 g per litre) are added; the latter at about 32° F. The whole is then filtered, neutralised before use, with |
| 20 ozs. | 300 g Sodium Acetate cryst. and made up with cold water to |
| 4 gall. | 10 litres. |

2. With Alpha Naphthylamine Hydrochloride paste 36%.

| | |
|-------------|---|
| 2 lbs. 1oz. | 500 g Alpha Naphthylamine Hydrochloride paste 36% is diluted with |
| 1 1/2 pts. | 500 cc Cold water |
| 8 lbs. | 2 k Ice |
| 2 2/3 gills | 200 cc Muriatic acid 36° Tw. are slowly added and then |
| 3 1/4 gills | 260 cc Sodium Nitrite solution (3 lbs. per gall.; 290 g per litre). The whole is filtered after 1/4 of an hour and before use |
| 20 ozs. | 300 g Sodium Acetate cryst. and made up to |
| 4 gall. | 10 litres. |

3. With Alpha Naphthylamine Salt S powder.

| | |
|-------------|--|
| 13 ozs. | 192 g Alpha Naphthylamine Salt S powder are made into a smooth paste with |
| 3 qts. | 2 L Cold water |
| 6 2/3 ozs. | 100 g Sulphuric acid 168° Tw. |
| 8 lbs. | 2 k Ice, and whilst stirring |
| 3 1/4 gills | 260 cc Sodium Nitrite solution (3 lbs. per gall.); (290 g per litre) are slowly added. After 1/4 of an hour the solution is filtered, thickened with |
| 4 lbs. | 1 k Tragacanth (60:1000); before use neutralised with |
| 20 ozs. | 300 g Sodium Acetate cryst. and made up to |
| 4 gall. | 10 litres. |

C. CHLORANISIDINE SCARLET.

| | | |
|-----------------------|------------|--|
| 13 $\frac{1}{2}$ ozs. | 200 g | Chloranisidine Salt M |
| 6 pts. | 2 l | Water |
| 2 $\frac{2}{3}$ gills | 200 cc | Muriatic acid 36° Tw. |
| 8 lbs. | 2 k | Ice |
| 3 $\frac{1}{2}$ gills | 260 cc | Sodium Nitrite solution (3 lbs. per gall.; 290 g per litre) The whole is filtered after 15 minutes, neutralised with |
| 20 ozs. | 300 g | Sodium Acetate, and made up to |
| 4 gall. | 10 litres. | |

D. BENZIDINE AND TOLIDINE PUCE.

| | | |
|-----------------------|------------|---|
| 12 ozs. | 180 g | Benzidine Base or |
| 14 ozs. | 210 g | Tolidine Base |
| 2 $\frac{2}{3}$ gills | 200 cc | Muriatic acid 36° Tw. |
| 3 pts. | 1 l | Boiling water |
| 8 lbs. | 2 k | Ice |
| 4 $\frac{1}{2}$ gills | 340 cc | Muriatic acid 36° Tw. |
| 1 pint 3 gills | 520 cc | Sodium Nitrite solution (3 lbs per gall : 290 g per litre). The whole is filtered after 15 minutes, neutralised before use with |
| 27 ozs. | 400 g | Sodium Acetate cryst. thickened with |
| 4 lbs. | 1 k | Tragacanth (60:1000) (10 ozs per gall.; 60 g per litre) and made up to |
| 4 gall. | 10 litres. | |

E. DIANISIDINE BLUE.

| | | |
|-------------------------|------------|--|
| 5 $\frac{1}{2}$ ozs. | 83 g | Dianisidine Salt |
| $\frac{2}{3}$ gills | 50 cc | Muriatic acid 36° Tw. |
| 13 $\frac{1}{2}$ ozs. | 200 g | Hot Water |
| 3 pts. | 1 l | Ice Water |
| 2 gills | 140 cc | Nitrite solution (3 lbs. per gall., 290 per litre). The whole is filtered after 10 minutes, then |
| 3 lbs. | 750 g | Flour Tragacanth thickening. |
| 1 pt. | 300 cc | Copper Chloride 76° Tw. or |
| or 2 $\frac{1}{2}$ pts. | 750 cc | Copper Solution N |
| $\frac{1}{2}$ oz. | 10 g | Chromic acid in solution added, and the whole made up to |
| 4 gall. | 10 litres. | |

| | | |
|-------------------------|------------|-----------------------------|
| 1 lb. | 250 g | Azophor Blue D |
| 3 gall. | 8 l | Spring Water |
| 3 lbs. | 750 g | Flour Tragacanth thickening |
| 1 pt. | 300 cc | Copper Chloride 76° Tw. or |
| or 2 $\frac{1}{2}$ pts. | 750 cc | Copper Solution N |
| $\frac{1}{2}$ oz. | 10 g | Chromic acid (in solution). |
| 4 gall. | 10 litres. | |

Copper Solution N.

| | | |
|----------------------|--------|--------------------------|
| 10 ozs. | 160 g | Copper Chloride (solid) |
| 2 $\frac{1}{2}$ ozs. | 42.6 g | Acetate of Copper cryst. |
| 1 qt | 600 g | Water |
| 5 ozs. | 80 g | Sodium Nitrite cryst. |
| 0 85 gills | 66 cc | Acetic acid 12° Tw. |
| | | 1 litre. |

Particulars as to the grounding for C, D and E, are contained in the chapter on Calico Printing. All other insoluble Azo Colours produced direct on the fibre are only used in Calico Printing. To these must be added:

Para Brown G, R,
Para Dark Brown G and R,

which are also discussed in the chapter on Calico Printing because they are only used as ground shades for discharge printing.

For mixture shades of Diazo compounds the stable Azophor Colours are used, as they are more suitable than diazo solutions.

b) COTTON COLOURS CLASSIFIED ACCORDING TO SPECIAL PROPERTIES.

The colours have been so grouped together in this chapter that the selection of the various dyestuffs suitable for certain purposes is a simple matter.

1. Cotton colours fast to bleaching.

Colours which are absolutely fast to bleaching, i. e. which do not lose in depth during the whole bleaching process, do not exist.

The bleaching of fancy woven goods must be so carried out that the shades are interfered with as little as possible and the final result remains satisfactory. Boiling without pressure, with Soda in place of Caustic Soda is especially advisable.

When taking these precautions, the following colours may be designated as "fast to bleaching":

| | |
|---|---|
| Alizarine Red IB paste 20% on Alumina, Alumina Iron, or Iron Mordant, | Helindone Orange R, |
| Alizarine Blue, all brands, on Oil-Tannin-Chrome mordant, | Helindone Brown G, |
| Indigo MLB, MLB/R, MLB RR, MLB/T, MLB 2B, MLB 4B, MLB 5B, MLB 6B, | Helindone Yellow GN, |
| Helindone Red B, 3B, | Aniline Black, |
| Helindone Scarlet S, | Diphenyl Black, |
| Helindone Fast Scarlet R, | Alizarine Yellow GG paste, 5G, on Chrome Mordant, |
| | Primuline, aftertreated with Bleaching liquor, |
| | Alizarine Orange N paste on Chrome Mordant. |

In order to prevent bleeding, Vat colours should be kier-boiled with the addition of Potassium Bromate.

2. Cotton colours fast to Chlorine.

In addition to the colours mentioned under No. 1 the following dyestuffs are not destroyed by treating them in a Chloride of Lime solution of usual concentration :

| | |
|--|--------------------------|
| Alizarine Yellow R on Chrome Mordant, | Aurophenine O, |
| Alizarine Orange on Alumina Mordant, | Dianil Fast Scarlet 8BS, |
| Alizarine Dark Blue on Chrome Mordant. | Metanitriline Orange, |
| Oxydianil Yellow O, G, | Paranitriline Red, |
| Dianil Direct Yellow S, | Azophor Red, |
| | Naphtylamine Claret, |
| | Thiogene Cyanine O, G. |

3. Cotton colours fast to Washing.

A.

The following colours may be washed with hot Soap and Soda without changing to any great extent or bleeding into white :

Alizarine Orange N paste on Alumina and Chrome Mordant,
 Alizarine Red paste 20% all brands, on Alumina- Chrome- and Iron-Mordant,
 Alizarine Claret R paste on Alumina and Chrome Mordant,
 Alizarine Brown all brands, on Alumina and Chrome Mordant,
 Alizarine Blue. all brands, on Chrome Mordant,
 Alizarine Dark Blue S, on Chrome Mordant,
 Alizarin Green S paste on Chrome Mordant,
 Ceruleine, all brands, on Alumina and Chrome Mordant,
 Galleine A paste on Chrome Mordant,
 Indigo MLB, MLB/R, MLB RR. MLB/T, MLB 2B, MLB 4B, MLB 5B, MLB/6B,
 Helindone Red B, 3B,
 Helindone Scarlet S,
 Helindone Fast Scarlet R,
 Helindone Orange R,
 Helindone Brown G,
 Helindone Yellow GN, in fact, all the vat colors
 Aniline Black,
 Diphenyl Black,
 Primuline O, aftertreated with Bleaching liquor.
 Cresotine Yellow G,
 Dianil Fast Orange O, RR,
 Dianil Fast Brown B, GR, 2G, 3R. } aftertreated with Bichrome
 Dianil Brown 3GO, MH, } and Copper Sulphate
 Dianil Chrome Brown G, R,
 Dianil Fast Olive Green GG,
 Dianil Black N, CR,
 Dianil Fast Red PH, aftertreated with Fluoride of Chrome.
 Nitroso Brown,
 Nitroso Green,
 All Thiogene Colours (Thiogene New Blues are somewhat inferior).

B.

Colours which are slightly inferior to those mentioned under A, but which are satisfactorily fast for all practical purposes: laundry washing etc.

| | |
|-------------------------------|------------------------------------|
| Alizarine Yellow R, GG paste, | Methylene Heliotrope O, |
| 5G, on Chrome Mordant, | Methylene Violet 2B, 4B, 6B, 8B. |
| Metanitriline Orange, | Violet Crystals O, |
| Azophor Orange, | Rosolane BO, |
| Paranitriline Red, | Victoria Blue, all brands, |
| Azophor Red, | Methylene Blue, all brands, |
| Alpha Naphtylamine Claret, | Marine Blue, all brands, |
| Dianisidine Blue, | Thionine Blue GO, |
| Azophor Blue, | Ethyl Blue BF, |
| Nitroso Blue, | New Ethyl Blue BS, RS, |
| Auramine, all brands, | Indamine Blue Nexta, R powder, |
| Indophene Blue B, G, RN, | Dianil Yellow 2R, 3G, after- |
| Janus Blue G, R, | treated with Chrome or |
| Janus Dark Blue R, B, | Chrome Copper, |
| Methylene Green, all brands, | Dianil Direct Yellow S. |
| Janus Green G, B, | Primuline O coupled with Azo- |
| Janus Black I, | phor Red or Azophor Orange, |
| Janus Grey BB, | Para Brown, |
| Methylene Grey, all brands, | Para Dark Brown, |
| Oxydianil Yellow O, G, after- | Primuline O, |
| treated with Chrome or | Diazanil Scarlet G, B, 6B, |
| Chrome and Copper Sulphate, | Dianil Brown |
| Methylene Yellow H, | MH, BH, |
| Flavophosphine, all brands, | Dianil Black ES, |
| Janus Yellow G, | Diazanil Black B, D, |
| Janus Brown B, R, | Dianil Azurine G, 3G, aftertreated |
| Rosazeine 4G, | with Copper, |
| Rosazeine Scarlet G, G extra, | Dianil Orange N, |
| Safranine, all brands, | Toluylene Orange R, |
| Safranine Scarlet 2G, | Dianil Black CR, R, |
| Janus Red B, | N, PR, |
| Methylene Violet 3RA extra, | Dianil Brown 3GO, |
| 2RA, 2RN, BN, | G, BD, 2G, 5G, |
| Primula R soluble in water, | B, R, D, M. |

} diazotised
and
developed.

} Aftertreated
with
Azophor Red.

4. Cotton colours fast to Water.

Most of the colours mentioned under No. 3 will also be satisfactory as regards fastness to water; the fastness to water of Dianil colours is considerably improved by an aftertreatment with Solidogen.

The following colours are also fast to water:

| | | |
|------------------------|---|------------------------------|
| Eosine, | } | aftertreated with Solidogen. |
| Erythrosine, | | |
| Phloxine, | | |
| Rose Bengale. | | |
| Eosine Scarlet, | | |
| Cyanosine, all brands. | | |

5. Cotton colours fast to Perspiration.

All colours with the exception of:

| | |
|---------------------------------|---------------------------|
| Brilliant Orange, | Rose Bengale, all brands. |
| Brilliant Croceine, all brands, | Dianil Red 4B. |
| Eosine, | Dianil Red R. |
| Erythrosine, | Dianil Claret Red G, B. |
| Phloxine, | |

6. Cotton colours fast to boiling Acids.

| | |
|--|--|
| Alizarine Orange N on Oil-Alumina and Oil-Chrome Mordant, | Methylene Violet, all brands. |
| Alizarine Red, all brands, on Old Red Mordant with the exception of SDG, | Methylene Heliotrope O, Safranine, all brands, |
| Alizarine Blue } all brands on | Rosazeine Scarlet G extra, |
| Alizarine Dark } Oil-Tannin- | Rosazeine, all brands, |
| Blue } Chrome Mord. | Thionine Blue GO, |
| Ceruleine, all brands on Oil-Alumina or Oil-Chrome Mordant, | Methylene Blue, all brands, |
| Indigo MLB, MLB/R, MLE, RR, MLE/T, | Methylene Green, all brands, |
| All These Colours. | Brilliant Green cryst, extra, |
| Magenta Yellow H, | Malachite Green, all brands, |
| Auramine, all brands, | Victoria Blue, all brands, |
| Flavophosphine, all brands, | Indophene Blue, all brands, |
| Azophosphine GO, | New Ethyl Blue BS, RS. |
| Rosolene RG, | Ethyl Blue BF, |
| | Indamine Blue N extra, R powder, |
| | Janus Yellow G, R. |
| | Janus Brown, R, B. |
| | Janus Green B, G, |
| | Janus Blue G, R, |
| | Janus Dark Blue B, R. |

The following colours developed with Azophor Red.

| | |
|--------------------|----------------------------|
| Dianil Orange N, | Dianil Brown G, 2G, 5G, R. |
| Tolulene Orange R, | M, BD, B, D. 3GO, |
| | Dianil Black CR, R, N, PR. |

The diazotised and developed shades of:

| | |
|------------------|------------------|
| Primuline O. | Dianil Brown BH, |
| Dianil Brown MH. | Dianil Black ES. |

Also the under-mentioned colours, aftertreated with Bichrome and Copper:

| | |
|---|--------------------------|
| Dianil Brown 3GO, MH, BH, | Dianil Black CR, T, N, R |
| Dianil Fast Brown B. R. | Solid Green, |
| Primuline O aftertreated with Chloride of Lime, | Azophor Orange, |
| Aniline Black. | Pr. ... Red, |
| Diphenyl Black. | Azophor Red. |
| Dianil Brown Brown R, G, | Naphthylamine Claret. |

Tannin-Tartar Emetic aftertreatments improve the fastness to boiling acids, of shades dyed with Basic colours.

7. Cotton colours fast to Acids.

a) The shades are not altered when spotted with Acetic acid of 12° Tw.

| | |
|-----------------------------------|---------------------------------|
| Methylene Yellow H, | Indamine Blue, all brands, |
| Auramine, all brands, | Conc. Cotton Blue, all brands, |
| Flavophosphine, all brands, | Pure Blue O, |
| Azophosphine GO, BRO, | Cotton Blue extra, |
| Thio-p. . . . extra, | Dianil Green B, G, BB, |
| Leather Yellow O. | Dianil Dark Green B. |
| Chrysoidine A cryst., C extra, | Dianil Fast Olive Green 2G, |
| Vesuvine extra yellow, conc., | Dianil Black ES. developed with |
| 2R, 4BG conc., | Phenylene diamine. |
| Cutch Brown G, D, | Dianil Black CR, R, N, after- |
| Cerise G, | treated with Azophor Red, |
| Grenadine O. 2R, | Dianil Black PR, |
| Maroon O. | Thiogene Golden Yellow AO, |
| Safranine, all brands, | Thiogene Yellow G, GG, |
| Safranine Scarlet 2G, 5249, | Thiogene Orange, all brands. |
| Magenta, all brands, | Thiogene Brown, all brands. |
| Cotton Light Blue O soluble, | Dianil Yellow 3G, |
| Methyl Blue for Cotton MLB, | Oxydianil Yellow O, G, |
| Methylene Green, all brands, | Dianil Yellow G, R, 2R, |
| Brilliant Green crystals extra, | Dianil Direct Yellow S, |
| Malachite Green, all brands, | Dianil Orange G, |
| Methylene Grey, all brands, | Dianil Fast Orange O, 2R, |
| Silk Grey O, fast to water, | Dianil Brown 5G, A (No. 8611), |
| Janus Yellow G, R, | G. BH, 2G, R, M, B, D, |
| Janus Red B. | Dianil Chrome Brown G. |
| Janus Brown R, B, | Dianil Japonine G, |
| Janus Blue G, R, | Dianil Brown MH, diazotised |
| Primuline O, aftertreated with | and developed, |
| Chloride of Lime or Azophor | Dianil Fast Scarlet 8BS, 6BS, |
| Red, or diazotised and deve- | 4BS, 4BL. GS, RS, |
| loped, | Dianil Scarlet 2R, aftertreated |
| Diazanil Scarlet G, B, 6B, diazo- | with Solidogen, |
| tised and developed, | Dianil Fast Red PH, |
| New Magenta O, | Dianil Crimson B, G, |
| Rosazeine Scarlet G, G extra. | Dianil Claret Red B, |
| Rosazeine, all brands, | Dianil Blue H6G, H3G, G, B, |
| Methyl Violet, all brands, | H2G, R, 2R, BX, HG, |
| Violet Crystals O. | Dianil Azurine G, 3G, 3R, |
| Marine Blue, all brands, | Dianil Indigo O, |
| Rosoline BO, | Dianil Dark Blue R, |
| Methylene Violet, all brands, | Indigo MLB/R, MLB/RR, |
| Methylene Heliotrope O, | MLB/T.MLB/BB, MLB, 4B, |
| Primula R. | MLB/5B, MLB 6B, |
| Thionine Blue GO. | Helindone Red B, 3B, |
| Withelone Blue, all brands, | Helindone Scarlet S, |
| Withelone . . . all brands, | Helindone Fast Scarlet R, |
| Fast Blue for Cotton, all brands, | Helindone Orange R, |
| Indophene Blue, all brands. | Helindone Brown G, |
| New Ethyl Blue BS, | Helindone Yellow GN, |
| Ethyl Blue BF, | (i. e. all Helindones) |

| | | |
|-------------------------------|------------|-----------------------------------|
| Alizarine Red. all brands. | on Alumina | Anthrol Blue NR paste, NG paste, |
| Alizarine Claret R. | or Chrome | Alizarine Yellow 5G |
| Alizarine Orange N, | Mordant, | powder, |
| Thiogene Khaki N conc., | | Galleine A paste, |
| Thiogene Brown yellow shade | | Alizarine Blue DN, |
| OG conc., | | B, SR paste, |
| Thiogene Rubine O, | | Alizarine Green S |
| Thiogene Dark Red, G. R, | | paste, |
| Thiogene Cyanine O, G, | | Ceruleine S powder, |
| Thiogene Blue B, R, RR, | | SW paste, |
| Thiogene New Blue JL, BL, 2RL | | Brilliant Orange G, |
| Thiogene Navy Blue R conc., | | Brilliant Croceine R, B, blueish, |
| Melanogen Blue B, BG after- | | Azophor Orange, |
| treated with Metal Salts, | | Azophor Red, |
| Thiogene Green BL extra, GL | | Paranitraniline. |
| extra, G, | | Alpha Naphtylamine Claret, |
| Thiogene Black, all brands, | | Diphenyl Black. |

b) The shades are slightly altered when spotted with Acetic acid of 12° Tw.

| | |
|------------------------------------|---------------------------------|
| Dark Brown M. | FFC conc., FFT conc., FFA |
| Janus Green B, G. | extra conc., RW extra, FB, |
| Janus Black I, | Thiogene Catechu R. |
| Primuline O developed with | Thiogene Heliotrope O, |
| Resorcine, | Thiogene Violet B, V, |
| Dianil Brown 3GO, | Thiogene Dark Blue BL, BTI, |
| Dianil Brown 5G, | Thiogene Green B, GG, |
| Dianil Japonine G aftertreated | Dianil Fast Brown B, GR 2G, 3R. |
| with Copper and Chrome | Brilliant Dianil Red R, |
| Copper. | Delta Purpurine 5B, |
| Dianil Brown 3R, X, | Dianil Scarlet 2R, |
| Dianil Brown MH, | Dianil Pink BD, |
| Dianil Chrome Brown R, | Dianil Violet H, |
| Dianil Indigo O, aftertreated with | Alizarine Brown on Alumina and |
| Copper, | Chrome Mordant, |
| Dianil Black ES. CR, CB, N, | Alizarine Yellow |
| T, R, | GG paste, R, |
| Diazanil Black B. D. diazotised | Alizarine Blue SB, |
| and developed, | Aniline Black. |
| Patent Dianil Black FF conc., | |

c) The shades are not altered when spotted with diluted Hydrochloric acid (100 cc Hydrochloric acid 36° Tw. per litre).

| | |
|----------------------------|----------------------------------|
| Azophosphine GO, | Indophene Blue G. B, RN, |
| Phosphine O, extra, | Indamine Blue R powder, |
| Rosazeine Scarlet G extra, | Conc. Cotton Blue No. I, No. II, |
| Fast Blue for Cotton RB, | Janus Brown B, |

Janus Blue R,
 Primuline O, developed with
 Chloride of Lime, Beta Naph-
 tol, Schaffer Salt, and Claret
 Developer.
 Diazanil Scarlet G, B, 6B, dia-
 zotised an developed,
 Dianil Yellow 3G, aftertreated
 with Copper,
 Oxydianil Yellow O,
 Dianil Yellow R, RR,
 Pure Blue O.
 Cotton Blue extra,
 Cotton Light Blue O soluble,
 Methyl Blue for Cotton MLB.
 Methylene Green O, extra yellow
 DG, extra yellow,
 Methylene Grey NFD, NFS,
 Dianil Black ES developed with
 Phenylene diamine,
 Dianil Black R, N, aftertreated
 with Azophor Red,
 Dianil Black PR.
 Thiogene Orange RG,
 Thiogene Green GC, aftertreated
 with Copper,
 Thiogene Brown GR, G2R. R,
 Thiogene Bronze G.
 Thiogene Khaki N conc.,

Thiogene New Blue JL and BL,
 Thiogene Black M liquid, B2R
 liquid, 4B liquid, 6BV liquid,
 Dianil Orange G, O,
 Dianil Fast Scarlet 4BS, 4BL,
 GS, RS, 6BS, 8BS,
 Dianil Blue H6G. B, G, R,
 3R, 4R,
 Dianil Azurine G, 3R, 3G,
 Dianil Blue BX,
 Dianil Indigo O,
 Dianil Fast Olive Green 2G,
 Thiogene Black MM conc., B2R
 conc., 4B conc.,
 Indigo MLB, MLB/R, MLB/RR,
 MLB/T, MLB/2B, MLB/4B,
 MLB/5B, MLB/6B,
 Helindone Red B, 3B,
 Helindone Yellow GN,
 Helindone Scarlet S,
 Helindone Fast Scarlet R,
 Helindone Orange R,
 Helindone Brown G, etc.
 Alizarine IB. No 1. 2A, 2AG,
 3RL, 5F on Alumina
 Mordant,
 Alizarine Orange N on Alumina
 Mordant.

Colours produced on the fibre

Azophor Orange,
 Azophor Red,
 Parantraniline Red,

Naphthylamine Claret,
 Diphenyl Black.

d) The shades are only slightly altered when spotted
 with diluted Hydrochloric acid (100 cc Hydrochloric
 acid 36° Tw. per litre):

Methylene Yellow H,
 Auramine, all brands.
 Vesuvine extra yellow, conc., 2R,
 4BG conc.,
 Rosazeine 4G, 6G,
 Thionine Blue GO,
 Methylene Blue BB extra. DBB
 extra, B conc.,
 Fast Blue for Cotton BB,
 New Fast Blue 3R crystals.
 New Ethyl Blue BS,
 Ethyl Blue BF,
 Dianil Brown MH, developed
 with Phenylenediamine or
 Beta Naphtol,

Dianil Brown B, D, M, R,
 direct, and aftertreated with
 Azophor Red,
 Dianil Fast Brown 3R,
 Dianil Scarlet 2R, developed
 with Solidogen.
 Dianil Azurine G, aftertreated
 with Copper,
 Dianil Blue 2R,
 Dianil Dark Blue R, 3R,
 Dianil Black R, CB, CR, T, N,
 Dianil Black ES, developed with
 Beta Naphtol,
 Indamine Blue N extra powder,
 Conc. Cotton Blue R,

| | |
|--------------------------------|-------------------------------|
| Methylene Grey ND. O. | Patent Dianil Black FF conc., |
| Janus Blue R. | FFC conc., FFT conc., EF |
| Janus Blue G. | conc., FFA extra conc., |
| Janus Dark Blue B, R. | RW extra, FB, |
| Primuline O, developed with | Thiogene Golden Yellow AO, |
| Resorcine. | Thiogene Yellow GG, G, |
| Dianil Yellow 3G. | Thiogene Orange OG, R, RR, |
| Oxydianil Yellow G. | Thiogene Brown GC, |
| Dianil Direct Yellow S. | Alizarine Red SDG paste, on |
| Dianil Brown 5G, X, G, BH. | Alumina Mordant, |
| Dianil Japonne G. | Alizarine |
| Thiogene Brown R, RR, S. | Orange N, } on Chrome |
| Thiogene Rubine O. | Alizarine Green S } Mordant. |
| Thiogene Dark Red G, R. | paste, |
| Melanogen Blue BG, B. both | Aniline Black |
| aftertreated with Fixing Salt, | |

8. Cotton colours fast to Ironing.

The following colours stand hot ironing without changing their shade

| | |
|---------------------------------|----------------------------------|
| Methylene Yellow H. | Violet Crystals O. |
| Flavophosphine, all brands, | Marine Blue, all brands, |
| Phosphine, all brands, | Victoria Blue, all brands, |
| Alizarine GO, BRO. | Malachite Green, all brands. |
| Cochineal A crystal, C crystal. | Brilliant Green, all brands. |
| C extra crystals, | Rosazeine, all brands. |
| Vesuvine, all brands, | Rosazeine Scarlet G, G extra. |
| Cutch Brown D, G, | Conc. Cotton Blue, all brands. |
| Dark Brown M. | Pure Blue, all brands |
| Magenta, all brands, | Methyl Blue for Cotton MLB, |
| New Fast Blue 3R crystals, | Methylene Blue, all brands, |
| Janus Yellow G, R. | Thionine Blue GO, |
| Janus Brown B, R. | Indamine Blue N extra, R powder, |
| Janus Red B. | Ethyl Blue BF, |
| Janus Green G, B, | Methylene Indigo O, SS, |
| Janus Blue G, R, | Methylene Dark Blue RBN. |
| Janus Black I, | 3BN, |
| Primuline O, aftertreated with | Indophene Blue B, G, |
| Bleaching liquor, or developed. | Methylene Green, all brands. |
| Oxydianil Yellow O, G, | Fast Cotton Blue, all brands, |
| New Magenta O, | Dianil Yellow 3G, G, R. |
| Cerise, all brands, | Dianil Pure Yellow HS, |
| Grenadine, all brands, | Dianil Direct Yellow S. |
| Maroon O, extra, | Aurophenne O, |
| Safranine Scarlet 3249, 2G, | Cresotine Yellow G, |
| Safranine, all brands, | Dianil Orange G, N, |
| Methylene Heliotrope O, | Toluylene Orange R. |
| Methylene Violet, all brands, | Dianil Fast Orange O, 2R. |
| Rosolane BO. | Dianil Brown MH, BH, 3GO, |
| Methyl Violet, all brands with | 2G, G, R, BD, D, B, |
| the exception of 4R and 5R. | Dianil Fast Brown B, GR, 2G, 3R. |

| | |
|---|--|
| Dianil Fast Scarlet 4BS, 4BL, GS, RS extra, 6BS, 8BS, | Ahzarine Red, all brands, |
| Dianil Fast Red PH, direct, and aftertreated with Fluouide of Chrome. | Alizarine Claret R paste, |
| Dianil Pink BD, | Alizarine Blue, all S brands, |
| Dianil Scarlet G, 2R, | Alizarine Dark Blue S. |
| Dianil Red R, 4B, 10B, | Alizarine Green S paste, |
| Brilliant Dianil Red R, | Ceruleine conc., S, S conc., SW paste, |
| Delta Purpurine 5B, | Galleine, all brands, |
| Dianil Violet H, | Alizarine Yellow 5G powder, |
| Dianil Green G, B, BBN, BN, GN, | GG paste, R paste, |
| Dianil Azurine 3G, aftertreated with Copper, | Indigo MLB, MLB/R, MLB/RR. MLB/T, MLB/2B, MLB 4B. MLB, 5B, MLB/6B, |
| Dianil Azurine 3R, diazotised and developed, | Helindone Red B, 3B, |
| Dianil Fast Olive Green GG, | Helindone Scarlet S. |
| Dianil Blue G, B, R, 2R, 3R, 4R, E, ET, BX, HG, H2G, H6G, | Helindone Fast Scarlet R, |
| Dianil Dark Blue R, 3R, | Helindone Orange R. |
| Diazanil Black B, D, diazotised and developed, | Helindone Brown G. |
| Dianil Black R, G, CR, PR, PG, | Helindone Yellow GN, etc. etc. |
| Patent Dianil Black, all brands, | Alizarine Orange paste, R paste. |
| Dianil Black, ES, direct, | Azophor Red, |
| Alizarine Orange paste, | Naphthylamine Claret. |
| Alizarine Brown, all brands, | Naphthylamine Dianisidine Blue, |
| | Aniline Black. |
| | Diphenyl Black, |
| | All Thiogene Colours. |

9. Cotton colours fast to Decatising.

All Vat Colours, Mordant Colours, Sulphur Colours, Colours produced on the fibre, also those aftertreated with Metal Salts or Azophor Red, and Dianil and Diazanil Colours diazotised and developed.

10. Cotton colours fast to Milling.

| | | |
|--|--|----------------------------|
| Alizarine Yellow GG paste, 5G, on Chrome Mordant, | Alizarine Blue, all brands, | } on Chrome Mordant, |
| Alizarine Orange paste on Chrome and Alumina Mordant, | Alizarine Dark Blue, all brands, | |
| Alizarine Red, all brands, on Alumina, Chrome or Iron Mordant, | Alizarine Green S paste, | |
| Alizarine Claret R, | Ceruleine, all brands, on Alu- mina and Chrome Mordant, | |
| Alizarine Brown, | Galleine, all brands, on Chrome Mordant, | |
| | Solid Green, | |

| | |
|---|---|
| Indigo MI R, MI B, MI BR, MI RR, MLB 4B, MLB 5B, MLB 6B. | Primuline O, aftertreated with Bleaching liquor, |
| Helindone Red B, 3B, | Cresotine Yellow G, |
| Helindone Scarlet S, | Dianil Chrome Brown R and G, aftertreated with Bichrome- and Copper-Sulphate, |
| Helindone Fast Scarlet R, | Dianil Brown 3GO, } aftertreated MH, } with |
| Helindone Orange R, | Dianil Fast Brown } Chrome- |
| Helindone Brown G, | B, R, } Copper- |
| Helindone Yellow GN, etc. etc. | Dianil Black CR, } Sulphuric G, N, T, } acid. |
| Aniline Black. | |
| Diphenyl Black. | |
| All Thiogene Colours, | |

Slightly less fast to milling are:

| | |
|---|---|
| Janus Yellow G, | Dianil Fast Scarlet 4BS, 4BL, 6BS, 8BS, GS, |
| Janus Brown B, R, | Methylene Violet 3RA, extra, |
| Janus Blue R, G, | Methylene Heliotrope O, |
| Janus Green G, B, | Methylene Blue BB extra, DBB extra, B conc, |
| Janus Grey B, BB, | Indamine Blue N extra, R, |
| Methylene Yellow H, | Ethyl Blue BF, |
| Flavophosphine 2G conc new, GR, | Indophene Blue B, G, RN, |
| Thionine Blue GO, | Methylene Green, all brands, |
| Methylene Grey, all brands, | Dianil Black MH, } diazotised BH, } and |
| Primuline O, diazotised and deve- loped, | Dianil Black ES, } developed, Dianil Orange N, } aftertreated |
| Toluylene Orange } with R, } Azophor | Dianil Brown BD, } aftertreated |
| Dianil Brown D, } Red, | R, 3GO, MH, } with |
| Dianil Fast Red PH, after- treated with Fluoride of Chrome. | Dianil Fast Brown B, R, } Bichrome- and Dianil Japonine G, } Copper- Dianil Black CR, } Sulphate. |

The shades obtained with Basic colours must be aftertreated with Tannin and Tartar Emetic.

11. Cotton colours fast to Stoving.

All Vat Colours, Sulphur Colours, Mordant Colours, and the following:

| | |
|-------------------------------------|---|
| Auramine, all brands, | Methylene Violet, all brands, |
| Vesuvine, all brands, | Methylene Heliotrope O, |
| Azophosphine GO, | New Ethyl Blue BS, RS, |
| Phosphine O, | Methylene Grey, all brands, |
| Methylene Blue, all brands, | Oxydianil Yellow O, G, |
| Vat Blue B, | Dianil Yellow R, 2R. |
| Methylene Blue, all brands, | Aurophenine O, |
| Thionine Blue GO, | Dianil Direct Yellow S, |
| Methylene Green O, extra yellow, | Cresotine Yellow G, |
| Safranine, all brands, | Primuline O, aftertreated with Bleaching liquor, |

Dianil Orange G, N,
 Dianil Orange R,
 Dianil 3GO, R,
 BD,
 Dianil Fast Brown B,
 Dianil Dark Blue R, 3R,
 Dianil Black CR, N,
 Dianil Brown MH,
 Dianil Pink BD,
 Dianil Fast Red PH,
 Dianil Fast Scarlet 4BS, 4BL,
 6BS, 8BS, GS, RS extra,

developed with
 Azophor Red.

Diazanil Scarlet G, B, 6B, dia-
 zotised and developed,
 Dianil Blue G, BX, 2G, B, R, 2R,
 2RS, 3R, H6G, H3G, HG,
 Dianil Indigo O,
 Dianil Green G,
 Dianil Azurine G,
 Dianil Dark Green B,
 Dianil Black CR,
 Diphenyl Black.

12. Cotton colours fast to Rubbing and Mangling.

Nitroso Blue,
 Nitroso Green,
 Oxidation Black,

Diphenyl Black,
 All Thiogene Colours.
 All Dianil Colours.

Colours fast to mangling are the Alizarine Colours, also:

Indigo MLB, MLB R, MLB/RR,
 MLB/T, MLB 2B, MLB 4B,
 MLB/5B, MLB/6B,
 Helindone Red B, 3B,
 Helindone Scarlet S,
 Helindone Fast Scarlet R,
 Helindone Orange R,
 Helindone Brown G, 3GN,
 Helindone Yellow 3GN,
 Helindone Grey BB,
 Auramine, all brands,
 Methylene Yellow H,
 Phosphine, all brands,
 Flavophosphine, all brands,
 Azophosphine, all brands,
 Chrysoidine, all brands,
 Janus Yellow G,
 Rosazeine, all brands,
 Fast Cotton Blue, all brands,

Indamine Blue N extra, NB
 extra, R,
 Indophene Blue B, G, RN,
 Janus Blue G, R,
 Rosazeine Scarlet G, G extra,
 Safranine, all brands,
 Safranine Scarlet 2G,
 Methylene Violet, all brands,
 Methylene Heliotrope O,
 Methylene Blue, all brands,
 Thionine Blue GO,
 Ethyl Blue BF,
 New Ethyl Blue BS, RS,
 New Fast Blue 3R crystals,
 Janus Dark Blue R, B,
 Janus Green G, B,
 Methylene Green, all brands,
 Methylene Grey, all brands.

13. Cotton colours fast to Light.

The following are very fast to light:

Alizarine Yellow R, GG paste,
 5G, on Chrome Mordant,
 Alizarine Orange on Chrome and
 Alumina Mordant,
 Alizarine Brown, all brands,
 Alizarine Red, all brands,
 Alizarine Claret R paste,

Alizarine Blue, all brands, on
 Chrome Mordant,
 Anthrol Blue NR paste, NG
 paste,
 Alizarine Green S paste, on
 Chrome Mordant,
 Ceruleine, all brands,

Dianil Chrome Brown G, after-chromed,
 Aniline Black,
 Diphenyl Black,
 Dianil Direct Yellow 3G, 2G, 1G, 10
 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
 MLB/5B, MLB/6B,
 Helindone Red B, 3B,
 Helindone Fast Scarlet R,
 Helindone Orange R, D,
 Helindone Brown G, 3GN,
 Helindone Yellow GN,
 Helindone Grey BB,
 Dianisidine Blue,
 Azophor Blue,
 Melanogene Blue B aftertreated
 with Metal salts,
 Thiogene Yellow G,
 Thiogene Orange OG, RG, R,
 RR aftertreated with Copper
 Sulphate,

Thiogene Brown GC, GR, GRR,
 R, RR, S,
 Thiogene Khaki N conc. after-
 treated with Bichrome and
 Copper Sulphate,
 Thiogene Catechu R,
 Thiogene Rubine O aftertreated
 with Copper Sulphate,
 Thiogene New Blue JL, BL,
 Thiogene Cyanine G, O,
 Thiogene Blue B, R, RR,
 Thiogene Dark Blue BL, BTI,
 Thiogene Green BL extra, GI,
 extra,
 Thiogene Black, all brands,
 Primuline O aftertreated with
 Bleaching liquor,
 Oxydianil Yellow O, G,
 Auropheine O,
 Cresotine Yellow G aftertreated
 with Copper Sulphate.

Slightly inferior are:

Galleine, all brands,
 Paranitriline Red,
 Azophor Red,
 All Sulphur colours not men-
 tioned under A.
 Auramine, all brands,
 Janus Yellow G, R,
 Phosphine, all brands,
 Azophosphine GO,
 Fluorophosphine 2G conc. new,
 S, G, brands,
 Rosolane BO,
 Methylene Violet, all brands,
 Methylene Heliotrope O,
 Methylene blue, all brands,
 Thionine Blue GO,
 New Fast Blue 3R, crystals,
 Fast Blue for Cotton, all brands,
 Indamine Blue, all brands,
 Ethyl Blue BF,
 New Ethyl Blue RS, BS,
 Indophene Blue B, G,
 Methylene Green, all brands,
 Methylene Grey, all brands,

Dianil Yellow 3G, aftertreated
 with Copper Sulphate,
 Dianil Yellow R, 2R,
 Dianil Direct Yellow S,
 Cresotine Yellow G,
 Dianil Orange G,
 Dianil Brown 2G, G, MH,
 Dianil Japonine G,
 Dianil Fast Brown 3R, GR, 2G,
 Dianil Pink BD,
 Dianil Crimson B, G,
 Dianil Fast Red PH,
 Dianil Fast Scarlet 4BS, 4BL,
 6BS, 8BS, GS, RS extra,
 Diazanil Scarlet G, B, 6B,
 Dianil Violet H,
 Dianil Indigo O, aftertreated with
 Copper Sulphate,
 Dianil Azurine G, aftertreated
 with Copper Sulphate,
 Dianil Azurine 3G, aftertreated
 with Copper,
 Dianil Fast Olive 2G,
 Dianil Black N, CR, ES.

14. Cotton colours fast to Vulcanizing.

In order to make cloth waterproof it is sometimes treated with rubber preparations. This process is called vulcanizing, and is carried out at 200 or at 230--235° F.

When using the cold method the goods are treated with a solution of rubber in Benzine, then dried in order to evaporate the Benzine and finally passed through a cold solution of 3% Sulphur Mono-Chloride in Carbon Bisulphide.

A very efficient vulcanizing process is the hot process. The goods are impregnated with rubber solution and an addition of Sulphur, dried and treated at $3\frac{1}{2}$ atm. for 1 hour. This process is liable to change the shades more or less, and attention has therefore to be paid to the selection of suitable colours.

For vulcanizing, the following dyestuffs have proved suitable, although none of them ought to be aftertreated with Metal Salts, especially with Copper, Manganese and Chromium Salts.

a) For hot Vulcanizing.

| | |
|-------------------------------|------------------------------|
| Dianil Yellow 3G, R, 2R, | Aniline Black, |
| Oxydianil Yellow O, G, | Diphenyl Black, |
| Dianil Direct Yellow S, | Methylene Yellow H, |
| Dianil Orange G, | Auramine, all brands, |
| Dianil Red 4B, 10B, | Flavophosphine 4G conc. new, |
| Dianil Fast Scarlet 4BS, 6BS, | R conc. new, |
| 8BS, GS, RS extra, | Rosazeine Scarlet G extra, |
| Dianil Claret Red B and G, | Magenta, all brands, |
| Dianil Blue G, B, R, 2R, 4R, | Victoria Blue B, 4R, |
| Dianil Indigo O, | Safranine O, |
| Dianil Dark Blue R, | New Magenta O, |
| Dianil Brown 3GO, G, R, M, | Rosazeine O, |
| B, BD, 3R, | Methyl Violet 6B, |
| Dianil Orange N, | Methylene Heliotrope O, |
| Toluylene Orange R, | The Thiogene Colours. |
| Dianil Black CR, G, N, | |

b) For cold Vulcanizing.

| | |
|-------------------------------|------------------------------|
| Dianil Yellow 3G, | Dianil Claret Red G, |
| Oxydianil Yellow O, | Dianil Blue G, B, R, 2R, 4R, |
| Cresotine Yellow G, | Dianil Dark Blue R, |
| Dianil Direct Yellow S, | Dianil Black CR, N, |
| Dianil Yellow R, 2R, | Rosazeine Scarlet G extra, |
| Dianil Orange G, | Thiogene Orange R, |
| Toluylene Orange R, | Thiogene Brown GC, GRR, S, |
| Dianil Brown 3GO, R, M, G, | Thiogene Catechu R, |
| D, BD, | Thiogene Cyanine O, |
| Paranitraniline Red, | Thiogene Blue B, |
| Dianil Red 4B, 10B, | Thiogene Black, all brands. |
| Dianil Fast Scarlet 4BS, 6BS, | |
| 8BS, GS, RS extra, | |

15. Cotton colours suitable for machine dyeing.

| | |
|-----------------------------|----------------------------|
| Methylene Yellow H, | Magenta, all brands, |
| Auramine, all brands, | Methyl Violet, all brands, |
| Flavophosphine, all brands, | Marine Blue, all brands, |

| | |
|------------------------------|--------------------------------|
| Malachite Green, all brands, | Thionine Blue GO. |
| Indophene Blue, all brands, | Methylene Green, all brands, |
| Ethyl Blue BF, | Brilliant Green, all brands, |
| New Ethyl Blue RS, BS, | Thiogène Cyanine O, G, |
| Conc. Cotton Blue R. I, II, | Thiogène Dark Blue BTL, |
| Methyl Blue for Cotton, | Thiogène Green B, GL extra, |
| Methylene Heliotrope O, | BL extra, |
| All Dianil Colours, | Thiogène Dark Red R, |
| Thiogène Golden Yellow AO, | Thiogène Catechu O, |
| Thiogène Yellow GG, G, | Thiogène Black MM conc., 2B |
| Thiogène Orange, all brands, | conc., B2R conc., 4B conc., |
| Thiogène Brown, all brands, | and the corresponding liquid |
| Thiogène Blue B, R, 2R, | brands, |
| Methylene Blue, all brands, | Thiogène Diamond Black V, |
| Safarine, all brands, | Thiogène Olive Green G, B, GG, |
| Rosazaine, all brands, | GGN. |

It ought to be borne in mind that when dyeing with **Basic colours** the Mordant baths (Tannin and Tartar Emetic) have to be more concentrated than when dyeing in an open cistern. After tanning, the liquid is drawn off, and the goods treated cold with 1% Tannin and rinsed. The dyeing operation is carried out at the ordinary temperature, the dyestuffs are gradually added and in about $\frac{1}{2}$ an hour the dye liquid heated to about 140° F. Finally the goods are rinsed.

The **DIANIL COLOURS** are applied as was stated under yarn dyeing. In place of Common salt or Calcined Glauber's salt, Glauber's salt crystals are used.

THIOGENE BLACK requires a greater addition of Salt to the dye bath (generally 100 parts of Glauber's salt crystals per 1000, in the initial bath). Old baths ought to stand at 9° Tw. The other Thiogene colours require for light shades, none, for medium and dark shades, small amounts of Glauber's salt. The Sodium Sulphide must be increased however.

16. The action of Hydrosulphite on cotton colours.

A great number of dyestuffs can be partly or entirely stripped off the fibre by means of Hydrosulphite. For this purpose Hydrosulphite NF and AZ are especially suitable.

Wooden cisterns are used, and the stripping bath prepared with 2.5% Hydrosulphite NF conc. and 3% Acetic acid 60°/10; the goods are entered lukewarm, the temperature gradually raised to the boil, and the goods boiled for $\frac{1}{2}$ — $\frac{3}{4}$ of an hour. Bisulphite may be used in place of Acetic acid.

Hydrosulphite AZ Hoechst is cheaper than Hydrosulphite NF. The stripping bath is prepared with 3% Hydrosulphite AZ which is previously mixed with water, and 1.5% of Formic acid. In place of the latter 3% of Acetic acid or Bisulphite may be used.

The numbers in the following table signify:

1. Colour is completely discharged,
2. Colour is partially destroyed,
3. Colour withstands Hydrosulphite.

| | | | |
|--------------------------|---|-------------------------|---|
| Dianil Yellow 3G . . . | 2 | Dianil Crimson B . . . | 1 |
| Dianil Pure Yellow HS | 3 | Dianil Claret Red G . . | 1 |
| Oxydianil Yellow G . . | 2 | Dianil Claret Red B . . | 1 |
| Oxydianil Yellow O . . | 2 | Dianil Violet H . . . | 1 |
| Cresotine Yellow G . . | 1 | Dianil Blue H6G . . . | 2 |
| Dianil Yellow G . . . | 2 | Dianil Blue H3G . . . | 2 |
| Aurophenine O . . . | 1 | Dianil Blue G . . . | 1 |
| Dianil Yellow R . . . | 2 | Dianil Blue B . . . | 1 |
| Dianil Yellow 2R . . . | 2 | Dianil Blue H2G . . . | 2 |
| Dianil Direct Yellow S | 1 | Dianil Azurine G . . . | 1 |
| Dianil Orange G . . . | 2 | Dianil Blue R . . . | 1 |
| Dianil Orange N . . . | 1 | Dianil Blue 2R . . . | 1 |
| Toluylene Orange R . . | 1 | Dianil Blue BX . . . | 1 |
| Dianil Brown 3GO . . . | 1 | Dianil Blue HG . . . | 1 |
| Dianil Brown 5G . . . | 2 | Dianil Indigo O . . . | 1 |
| Dianil Chrome Brown G | 1 | Dianil Dark Blue R . . | 1 |
| Dianil Chrome Brown R | 1 | Dianil Dark Blue 3R . . | 1 |
| Dianil Brown 2G . . . | 1 | Dianil Blue 3R . . . | 1 |
| Dianil Japonine G . . . | 1 | Dianil Blue 4R . . . | 1 |
| Dianil Brown 3R . . . | 1 | Dianil Green G . . . | 1 |
| Dianil Brown R . . . | 1 | Dianil Green B . . . | 1 |
| Dianil Brown MH . . . | 1 | Dianil Dark Green B . . | 1 |
| Dianil Brown X . . . | 1 | Dianil Black ES . . . | 2 |
| Dianil Brown G . . . | 1 | Dianil Black G . . . | 1 |
| Dianil Brown M . . . | 1 | Dianil Black CR . . . | 1 |
| Dianil Fast Brown R . . | 1 | Dianil Black R . . . | 1 |
| Dianil Fast Brown B . . | 1 | Dianil Black CB . . . | 1 |
| Dianil Brown BR . . . | 1 | Dianil Black PG . . . | 1 |
| Dianil Brown BD . . . | 1 | Dianil Black PR . . . | 1 |
| Dianil Brown B . . . | 1 | Patent Dianil Black | |
| Dianil Brown D . . . | 1 | FF conc. | 1 |
| Dianil Red 4B . . . | 1 | Patent Dianil Black | |
| Brilliant Dianil Red R . | 2 | FFC conc. | 1 |
| Dianil Red R | 1 | Patent Dianil Black | |
| Delta Purpurine 5B . . | 1 | FFA extra conc. . . | 1 |
| Dianil Fast Scarlet 8BS | 2 | Patent Dianil Black | |
| Dianil Scarlet G . . . | 1 | RW extra | 1 |
| Dianil Scarlet 2R . . . | 1 | Patent Dianil Black | |
| Dianil Pink BD . . . | 1 | EB conc. | 1 |
| Dianil Fast Scarlet 4BS | 2 | Patent Dianil Black | |
| Dianil Fast Scarlet 6BS | 2 | FB conc. | 1 |
| Dianil Fast Scarlet RS | | Turkey Red | 3 |
| extra | 2 | Paranitraniline Red . . | 2 |
| Dianil Fast Scarlet GS | 2 | Azophor Red | 2 |
| Dianil Fast Scarlet 8BS | 2 | Aniline Black | 3 |
| Dianil Red 10B | 1 | Diphenyl Black | 3 |
| Dianil Fast Red PH . . | 1 | Indigo MLB | 2 |
| Dianil Crimson G . . . | 1 | Indigo MLB/T | 2 |

17. The effect of mercerising lyes on cotton colours.

The numbers signify the degree of bleeding on to the white, when treated with **Caustic soda lye** 57° Tw.

1. Colour does not bleed.
2. Bleeds a little
3. Bleeds noticeably.
4. Bleeds considerably.

| | Change | Bleeding |
|---|---------------------------|----------|
| Dianil Yellow 3G | fuller, slightly greener | 1 |
| Dianil Pure Yellow HS | " " " | 1-2 |
| Oxydianil Yellow G | fuller | 1-2 |
| Oxydianil Yellow O | " | 1-2 |
| Cresotine Yellow G | " | 2 |
| Dianil Yellow G | " | 2 |
| Aurophenine O | " | 2 |
| Dianil Yellow R | " | 2 |
| Dianil Yellow 2R | " | 2 |
| Dianil Direct Yellow S | " | 1-2 |
| Dianil Orange G | fuller, slightly yellower | 1-2 |
| Dianil Orange N | fuller, slightly redder | 1-2 |
| Dianil Orange F | " " " | 1-2 |
| Dianil Orange R | " " " | 1-2 |
| Toluylene Orange R | " " " | 1-2 |
| Dianil Brown 3GO | " " " | 1-2 |
| Dianil Brown 5G | " " " | 1-2 |
| Dianil Copper Brown O | fuller | 2 |
| Dianil Brown 2G | fuller, slightly redder | 2 |
| Dianil Japonine G | " " " | 2 |
| Dianil Brown 3R | " " " | 2 |
| Dianil Brown R | fuller, slightly yellower | 2 |
| Dianil Brown MH | fuller | 2 |
| Dianil Brown MH (Diazotised and developed) | " | 1 |
| Dianil Brown X | " | 2 |
| Dianil Brown G | " | 2 |
| Dianil Brown M | " | 2 |
| Dianil Fast Brown R | " | 1-2 |
| Dianil Fast Brown B | " | 1-2 |
| Dianil Brown BR | " | 2 |
| Dianil Brown BD | " | 2 |
| Dianil Brown B | " | 2 |
| Dianil Brown D | " | 2 |
| Dianil Red 4B | " | 3 |
| Brilliant Dianil Red R | " | 3 |
| Dianil Red R | " | 3 |
| Delta Purpurine 5B | " | 3 |
| Dianil Fast Scarlet 4BS | " | 3 |
| Dianil Fast Scarlet 6BS | " | 3 |
| Dianil Fast Scarlet 8BS | " | 3 |
| Dianil Fast Scarlet GS | " | 3 |

| | Change | Bleeding |
|-------------------------------------|---------------------------|----------|
| Dianil Fast Scarlet RS extra | fuller | 3 |
| Dianil Scarlet 2R | " | 4 |
| Dianil Pink BD | " | 2-3 |
| Dianil Scarlet G | " | 4 |
| Dianil Fast Scarlet 8BS . . | " | 3 |
| Dianil Red 10B | " | 3 |
| Dianil Fast Red PH | " | 3 |
| Dianil Crimson G | " | 3 |
| Dianil Crimson B | " | 3 |
| Dianil Claret Red G | " | 3 |
| Dianil Claret Red B | " | 3 |
| Dianil Violet H | " | 3 |
| Dianil Blue H6G | " | 2-3 |
| Dianil Blue H3G | " | 3-4 |
| Dianil Blue G | " | 3 |
| Dianil Blue B | " | 3 |
| Dianil Blue H2G | " | 3 |
| Dianil Azurine G | " | 2 |
| Dianil Blue R | " | 3 |
| Dianil Blue 2R | " | 3 |
| Dianil Blue BX | " | 3 |
| Dianil Blue HG | " | 3 |
| Dianil Indigo O | " | 3 |
| Dianil Dark Blue R | fuller, redder | 3 |
| Dianil Dark Blue 3R | fuller | 3 |
| Dianil Blue 3R | fuller, slightly greener | 3 |
| Dianil Blue 4R | " " " | 3 |
| Dianil Green B | fuller, slightly yellower | 1-2 |
| Dianil Green BB | " " " | 2 |
| Dianil Green G | " " " | 2 |
| Dianil Dark Green B | " " " | 2 |
| Dianil Black ES | fuller | 4 |
| Dianil Black ES (Beta Naphtol) | " | 2 |
| Dianil Black G | " | 4 |
| Dianil Black CR | " | 4 |
| Dianil Black CR (Beta Naphtol) | " | 3 |
| Dianil Black R | " | 4 |
| Dianil Black CB | " | 4 |
| Dianil Black PG | " | 4 |
| Patent Dianil Black FF conc. | " | 2 |
| Patent Dianil Black FFC conc. | " | 2 |
| Patent Dianil Black FFT conc. | " | 2 |
| Patent Dianil Black FFA extra conc. | " | 2-3 |
| Patent Dianil Black RW extra | " | 2-3 |
| Patent Dianil Black EB conc. | " | 2-3 |
| Patent Dianil Black FB . . | " | 2 |
| Thiogene Golden Yellow AO | fuller, slightly redder | 1 |
| Thiogene Yellow GG | " " " | 1 |
| Thiogene Yellow G | " " " | 1 |

| | Change | Bleeding |
|--|---------------------------|----------|
| Thiogene Orange OG . . . | fuller, slightly redder | 1 |
| Thiogene Orange RG . . . | " " " | 1 |
| Thiogene Orange R . . . | " " " | 1 |
| Thiogene Orange RR . . . | fuller, slightly yellower | 1 |
| Thiogene Brown GC . . . | " " " | 1 |
| Thiogene Khaki O . . . | fuller | 1 |
| Thiogene Bronze G . . . | " " " | 1 |
| Thiogene Brown GR . . . | fuller, slightly yellower | 1 |
| Thiogene Brown GRR . . . | " " " | 1 |
| Thiogene Brown R . . . | " " " | 1—2 |
| Thiogene Brown RR . . . | " " " | 2 |
| Thiogene Brown S . . . | " " " | 1 |
| Thiogene Catechu R . . . | " " " | 2 |
| Thiogene Dark Red G . . . | " " " | 2 |
| Thiogene Dark Red R . . . | " " " | 1—2 |
| Thiogene Rubine O . . . | " " " | 2 |
| Thiogene R . . . O, after treated with Copper . . . | fuller | 1 |
| Thiogene Hchotrops O . . . | " " | 1 |
| Thiogene Violet B . . . | fuller, redder | 1 |
| Thiogene Violet V . . . | " " | 1 |
| Thiogene Cyanine G . . . | " " | 1 |
| Thiogene Cyanine O . . . | " " | 1 |
| Thiogene Blue B . . . | " " | 1 |
| Thiogene Blue R . . . | " " | 1 |
| Thiogene Blue RR . . . | " " | 1 |
| Thiogene Dark Blue BTL . . . | " " | 1 |
| Melanogen Blue B . . . | " " | 1 |
| Thiogene Green B . . . | fuller | 1 |
| Thiogene Green G . . . | " " | 1 |
| Thiogene Green GG . . . | " " | 1 |
| Thiogene Green BL extra . . . | " " | 1 |
| Thiogene Green GL extra . . . | " " | 1 |
| Thiogene Black M conc. . . | fuller, bluer | 1 |
| Thiogene Black BB conc. . . | " " | 1 |
| Thiogene Black BRR conc. . . | " " | 1 |
| Thiogene Black M liquid . . . | " " | 1 |
| Thiogene Black 4B conc. . . | " " | 1 |
| Thiogene Diamond Black V . . . | fuller bluer | 1 |
| Para Red . . . | " | 2 |
| Turkey Red . . . | " | 1 |
| Indigo MLB . . . | puer, bluer | 1 |
| Indigo MLB/T . . . | fuller, redder | 1 |
| Aniline Black . . . | fuller, browner | 1 |
| Diphenyl Black . . . | " " | 1 |

Basic shades are destroyed by Caustic lyes.

HALF WOOL DYEING.

(COTTON AND WOOL UNION FABRICS.)

The methods employed for half wool dyeing are:

1. Dyeing in an Acid bath, leaving the cotton white: the latter may afterwards be topped, as required.

A. Dyeing of the Wool.

B. Dyeing of the Cotton.

a) Dyeing the cotton with Basic colours.

b) Dyeing the cotton with Janus colours.

c) Dyeing the cotton with Dianil colours.

d) Dyeing "in the milling process".

2. Dyeing the cotton in the yarn and covering the wool in the piece.

3. Dyeing the wool and cotton simultaneously,

a) in a neutral salt bath,

b) in an acid bath.

4. Dyeing with Sulphur colours.

A. Initial covering of the cotton in half-wool and shoddy goods.

B. Production of two-colour effects on half wool.

C. Self shades on half-wool goods

D. Covering the cotton with Melanogen B and T or Thiogene Brown R.

1.

A. DYEING OF THE WOOL.

The wool is dyed in the usual manner, with this exception that the bath is worked more strongly acid, by which means the cotton (effect-threads etc.) remains whiter. After dyeing, the goods are hydroextracted as soon as possible and dried to avoid the effect-threads being stained through the colour bleeding.

a) Wool Colours which do not stain cotton effect-threads, when dyed in an acid bath.

Chinoline Yellow O,

Naphthol Yellow S, SE,

Flavazine S, L, 3GL, 5GL,

Flavazine T,

Fast Yellow O, S new,

Chrysoine G,

| | |
|--------------------------------|---------------------------------|
| Nassovia Scarlet O, | Naphtalene Dark Blue EB extra, |
| Sulpho Rosazaine G, B, | EG extra. |
| Azo Brilliant Red G, | Naphtalene Blue B, B extra, DL, |
| Azo Brilliant Carmine B, | LR, DN extra, BN conc., D, |
| Fast Red S, | Azo Acid Blue B, |
| Victoria Rubine O, G, | Patent Marine Blue B, V, LE, |
| Naphtol Red O, S, | LEN, LER, |
| Brilliant Crimson O, | Fast Dark Blue B extra, |
| Orseille Substitute G, | Acid Green, all brands, |
| Azo Acid Red B, 5B, BDA, | Naphtalene Green V, conc., |
| Azo Acid Carmine B, | Patent Green VS, V, O, |
| Amido-Naphtol Red G, 2B, 6B, | Fast Acid Green BB, BB extra, |
| Azo Acid Blue B, G, B, | BB conc. |
| Chromotrope all brands, | Acid Violet 3RS, 4RS, 6BN, |
| Orange G, | Victoria Violet, all brands, |
| Scarlet R to 6R, | Alizarine Direct Violet R, |
| Scarlet 6R crystals, | Alizarine Direct Blue B, EB, |
| Victoria Scarlet 2R to 6R, | E3B, ER extra, |
| New Cocaine O, | Cyanine B, |
| Milling Scarlet 4RO, 4R conc., | Wool Green BH, |
| Patent Blue V, N, L, LE, | Cyanine Green N, |
| superior, VR, VB, 2R, | Naphtalene Dark Green N, |
| Patent Pure Blue O, | Alizarine Direct Green G, |
| Indigo Substitute V extra, SB | Azo Acid Black, all brands, |
| extra, B extra, A extra. | Carbon Black, all brands, |
| Amido Blue B, GR, | Amido Black 3B, |
| Azo Discharge Blue DX, | |

b) Wool Colours which do not stain cotton when dyed in an acid bath and developed with Fluoride of Chrome.

| | |
|-----------------------------|--------------------|
| Acid Alizarine Blue BB, | Mordant Yellow O, |
| Acid Alizarine Green G, | Alizarine Red IWS. |
| Fast Mordant Blue B, R, EG, | |
| BT, RT, | |

c) Wool Colours suitable for dyeing in an acid bath and developing with Potassium Bichromate.

| | |
|------------------------------|--------------------------------|
| Mordant Yellow O, | Chromotrope Blue A, WG, WB, |
| Chrome Brown. | Chromotrope FB, F4B, DW, |
| Chromogene I, | 8B, 10B, S, |
| Acid Alizarine Brown RH | Fast Mordant Blue B, R, EG, |
| extra, RP, | BT, RT, |
| Acid Alizarine Red G, B, | Acid Alizarine Black 3B extra, |
| Acid Alizarine Grenade R, | R, R extra, RG, RH, AC, |
| Acid Violet N, | SN, SNG, |
| Alizarine Red IWS, PS, | Acid Alizarine Blue Black A, |
| Alizarine Direct Violet R, | Copper Black SB, |
| Alizarine Direct Blue B, EB, | Fast Acid Black R, T, 3B, BG, |
| E3B, ER extra, | |

The Chrome Developing colours, which do not stain cotton effect-threads etc. are especially suitable for material upon which high demands are made, in respect to fastness to perspiration and water, viz: for medium quality dress goods.

It may here be pointed out that some of the colours under a), b) and c) are more or less taken up by cotton which has been dyed with Basic or Sulphur colours, because these act as a sort of mordant for several wool colours. This remark applies to the following colours mentioned under A:

| | |
|-------------------------------|--------------------------------|
| Victoria Violet 4BSL, | Azo Acid Black 3BLOO, |
| Patent Blue V, NL. LE, | Chromotrope Blue A, |
| Patent Marine Blue LE, | Acid Alizarine Black 3B extra, |
| Naphtalene Green V, | RG. |
| Fast Acid Green BB, BB extra, | |
| BB extra conc , | |

B. DYEING OF THE COTTON.

a) Dyeing the cotton with Basic colours.

This method is employed in particular industries, e. g. for Zanella and certain kinds of dress materials, since the goods are very easily affected by boiling in a neutral bath.

They lose their handle and lustre, becoming ragged and showing creases, which cannot afterwards be removed.

For piece-dyed woollen goods with coloured effect-threads the reverse of the above process may be employed, viz: the cotton is first dyed as fast as possible (e. g. with Basic colours on a Tannin-Antimony-Mordant) and the wool afterwards dyed with Acid colours; in many cases it is easier to dye to shade by this method.

All Acid colours may be employed for dyeing in an acid bath. After dyeing, the goods are well rinsed and then mordanted: light shades with Tannin, dark shades with Sumach; the former are fixed with Tartar Emetic and the latter with Nitrate or Pyrolignite of Iron. The goods are then well rinsed and the cotton dyed to shade in a cold bath with Basic colours.

| | |
|-----------------------------------|----------------------------------|
| Methylene Yellow H, | Methylene Green O, extra yellow, |
| Auramine conc., O, I, II, | extra yellow conc., G, 2G, 3G, |
| Azophosphine GO, | Methylene Blue, all brands, |
| Flavophosphine, all brands | Thionine Blue GO, |
| Chrysoidine A crystals, C cryst., | Marine Blue BI, RI, 2R, |
| C extra cryst., | Methylene Heliotrope O, |
| Vesuvine, all brands, | Methylene Violet RRA, BN, |
| Magenta, all brands, | RRA conc., 3RA extra, |
| New Magenta O, | Methylene Grey NFS, O, |
| Methyl Violet, all brands, | Safranine, all brands, |
| Malachite Green, all brands, | Rosazine, all brands. |
| Brilliant Green, all brands, | |

A new patented process introduced by us, effects a considerable improvement in the two-bath method of dyeing half-wool goods,

The wool is dyed with Acid colours in an Acid bath, in the presence of Tannin and Metal Salts. By this means its affinity for the colours used for the dyeing of the cotton is decreased or totally destroyed. The cotton is finally topped with Dianil colours.

This process is superior to the one-bath method of dyeing half-wool, since the shade of the wool is more even and more easily obtained. Besides, previously treated coloured wool threads may be employed for special effects (according to the D.R.P. 137 947).

Finally the shades are considerably faster to rubbing than those in which the cotton has been dyed with Basic colours.

b) Dyeing the cotton with Janus colours.

A concentrated bath is employed, which is prepared with about 4% Hydrochloric acid and the solution of the Janus colour. The well-rinsed goods are entered, dyed for $\frac{1}{4}$ of an hour, then twice or three times as much Tannin as dyestuff is added and dyeing continued for 15 minutes. In order to fix the colour thoroughly, Tartar Emetic, equal to half the amount of Tannin used, is added to the dyebath in the case of light shades, or to the rinsing bath in the case of dark shades.

| | |
|-------------------|-----------------------|
| Janus Yellow G, | Janus Green G, B, |
| Janus Brown R, B, | Janus Grey B, 2B, |
| Janus Red B, | Janus Black I, II, O. |
| Janus Blue G, R, | |

c) Dyeing the cotton with Dianil colours.

This method of dyeing is employed for producing plain shades as well as for two colour effects. The wool is first dyed in the usual manner and well washed, a little Ammonia or Soda being added to the rinsing bath. The cotton is then dyed with Dianil colours for about $\frac{3}{4}$ of an hour in a luke-warm bath, rinsed, and the goods finished in a weak Acetic acid bath.

For this method of working, the following colours are suitable:

| | |
|----------------------------------|-------------------------------|
| Dianil Yellow 3G, R, RR, | Dianil Chrome Brown G, R, |
| Dianil Direct Yellow S, | Dianil Fast Brown B, |
| Oxydianil Yellow O, G, 3G, | Dianil Blue G, B, R, RR, 3R, |
| Dianil Orange G, 2R, | 4R, BX, H2G, H3G, H6G, |
| Dianil Fast Orange O, 2R, | Dianil Indigo O, |
| Dianil Red 4B, 10B, | Dianil Azurine G, 3G, 3R, |
| Dianil Fast Scarlet RS, GS, 4BS, | Dianil Dark Blue R, 3R, |
| 4BL, 6BS, | Dianil Green BBN, BN, GN, |
| Dianil Claret Red G, B, | Dianil Black PR, PG, CR, HW, |
| Dianil Violet H, | N, E, ES, |
| Dianil Brown R, BD, G, B, D, | Patent Dianil Black EF conc., |
| M, 3GO, MH, | FF conc. |
| Dianil Copper Brown O, | |

d) Dyeing "in the milling process".

In order to dye the burls in half-wool, shoddy etc goods, in as simple a manner as possible, the dyeing process is carried out simultaneously with the milling process. Cotton wool suffices to tint the burls to a dark grey. For this purpose Black CR is dissolved in an alkaline Soap solution at 122 °F. After scouring, rinsing and hydroextracting, the goods are run into the mill, and the cold dyestuff solution is then added to the mill. About 10 minutes before taking the pieces out, a concentrated solution of Glauber's salt is added, and the goods finally well rinsed.

For certain shoddy goods, the cotton may be dyed in the milling process first, with Patent Dianil Black FFC conc. The goods are then allowed to lie for some time, they are then unsized slightly and the wool finally dyed for $\frac{1}{2}$ to 1 hour in a boiling Acid bath containing 10% Glauber's salt and 6—8% Sulphuric acid. Patent Dianil Black FFC. conc. cannot be used for covering cotton in goods already dyed.

2.

DYEING THE COTTON IN THE YARN AND COVERING THE WOOL IN THE PIECE.

The undermentioned colours are fast to cross dyeing, and may be employed for dyeing the cotton. For two-colour effects, the wool is dyed with the colours given in the previous chapter, which stain the cotton only very slightly. For plain shades any wool colour may be used.

| | |
|---|--|
| Alizarine Orange N on Oil-Alumina and Oil-Chrome mordant, | Bullant Green crystals extra, |
| Alizarine Red, all brands, on Old-Red mordant, with the exception of SDG, | Malachite Green, all brands, |
| Alizarine } all brands | Victoria Blue, all brands |
| Dark Blue, } on Oil-Fannin | I 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100 |
| Alizarine Blue, } Chrome Mordant, | MLB/5B, MLB/6B, |
| Ceruleine, all brands, on Oil-Alumina or Oil-Chrome mordant, | Helindone Red 3B, B, |
| Auramine, all brands, | Helindone Fast Scarlet R, |
| Flavophosphine, all brands, | Helindone Scarlet S, |
| Azophosphine GO, | Helindone Orange R, |
| Rosolane BO, | Helindone Yellow 3GN, |
| Methylene Violet, all brands, | Helindone Brown G, |
| Methylene Heliotrope O, | All the above colours, |
| Safrianine, all brands, | New Yellow H, |
| Rosazeine Scarlet G extra, | Indophene Blue, all brands, |
| Rosazeine, all brands, | New Ethyl Blue BS, RS, |
| Thionine Blue GO, | Ethyl Blue BF, |
| Methylene Blue, all brands, | Indamine Blue N extra, R powder, |
| Methylene Green, all brands, | Janus Yellow G, R, |
| | Janus Brown R, B, |
| | Janus Green B, G, |
| | Janus Blue G, R, |
| | Janus Dark Blue B, R. |

The Azophor Red aftertreated shades of:

Dianil Orange N,
Toluylene Orange R,
Dianil Brown G, 2G, 5G, R,
M. B. D, 3GO,
Dianil Black CR, R, N. PR,
The Chrome-Copper aftertreated shades of:

Dianil Brown 3GO, MH, BH,
Dianil Fast Brown B, GR, 3R,
2G, B,
Dianil Yellow 3G,
Dianil Fast Orange G, RR,
Dianil Chrome Brown R, G.

Dianil Black CR, T, N, R,
Primuline O, aftertreated with Chloride of Lime,
Aniline Black,
Diphenyl Black,
Azophor Orange,
Paranitraniline Red,
Azophor Red,

The diazotised and developed shades of:

Primuline O,
Diazanil Scarlet G, B, 6B,
Dianil Azurine 3R,
Dianil Brown MH, BH,
Dianil Black ES.

The fastness to cross-dyeing of Basic colours is improved by aftertreating with Tannin and Tartar Emetic.

3.

DYEING THE WOOL AND COTTON SIMULTANEOUSLY.

a) in a neutral bath containing Glauber's salt.

This process is almost universally employed for dyeing cheap half-wool dress materials, hosiery, braids, felt etc. The goods are dyed in a bath containing 20—40 parts of Glauber's salt cryst. per 1000 parts of water, according to the depth of shade required. The Glauber's salt must be neutral.

In order to produce as level shades as possible, the goods are entered at about 120—140° F. for light shades; this will prevent the wool from taking up immediately the greater part of the colour and leaving the cotton light. For dark shades the goods may be entered into the hot dyebath. Should the shade of the cotton be too light, the bath is allowed to cool down somewhat. The lustre of mercerised cotton can be restored by means of a little Acetic acid.

When dyeing further lots in old baths about one fifth of the amount of Glauber's salt and $\frac{3}{4}$ — $\frac{2}{3}$ of colour are required.

Dianil colours which dye wool and cotton alike in a bath containing Glauber's salt.

Dianil Pure Yellow HS,
Dianil Yellow 3G, R, 2R,
Oxydianil Yellow 3G,
Chrysophenine O,
Dianil Orange N,
Dianil Fast Orange O,
Delta Purpurine 5B,
Dianil Blue BX,

Dianil Indigo O,
Dianil Chrome Brown G,
Dianil Brown MH, 3GO, 3R,
Dianil Copper Brown O,
Dianil Red R, 4B, 10B,
Half Wool Blue BD, R, BB, G,
Dianil Black N, E,
Patent Dianil Black EF conc.,

| | |
|--------------------------------|------------------------------|
| Half Wool Black B, | Black for Garments O, |
| Azo Half Wool Black 3BL extra, | Half Wool Black for Printing |
| TL extra, | EBS. |

**Dianil colours which dye the cotton deeper than the wool
in a bath containing Glauber's salt.**

| | |
|---------------------------------|------------------------------|
| Dianil Direct Yellow S, | Dianil Blue G, B, R, 2R, 3R, |
| Oxydianil Yellow O, G, | 4R, HG, H2G, H3G, H6G, |
| Dianil Orange G, | Dianil Azurine G, 3G, |
| Dianil Fast Orange 2R, | Dianil Dark Blue R, 3R, |
| Dianil Fast Scarlet GS, RS, | Dianil Green BBN, BN, GN, |
| 4BS, 4BL, 6BS, | Dianil Black ES, PR, PG, CR, |
| Dianil Brown R, BD, G, B, D. M, | HW, |
| Dianil Fast Brown B, | Patent Dianil Black FF conc, |
| Dianil Violet H, | Half Wool Black W, T. |

**Dianil colours which dye the wool deeper than the cotton
in a bath containing Glauber's salt.**

| | |
|-------------------------|----------------------------------|
| Aurophenine O, | Dianil Crimson G, B, |
| Dianil Orange N, | Dianil Pink BD, |
| Dianil Yellow G, | Brilliant Dianil Red R, R conc., |
| Cresotine Yellow G, | Dianil Green G, |
| Toluylene Orange R, | Dianil Black T, |
| Dianil Scarlet G, 2R, | Patent Dianil Black EB conc., |
| Dianil Fast Red PH, | EBV conc. |
| Dianil Claret Red G, B, | |

**Dianil colours which dye wool a different shade from cotton
in a bath containing Glauber's salt.**

| | |
|------------------------|-------------------------|
| Dianil Japonne G, | Dianil Blue E, ET, |
| Dianil Brown 5G, | Dianil Black AC, CB, R, |
| Dianil Chrome Brown R, | RN extra |

Dyestuffs suitable for shading the wool.

The following wool colours are applicable in a neutral Glauber's salt bath, and may therefore be used for shading purposes:

| | |
|-----------------------------------|------------------------------------|
| Chinoline Yellow O, | Patent Blue A, A2R, A4R, |
| Azoflavine H, | Alizarine Direct Blue B, |
| Azo Yellow O, conc., | Acid Violet 6BN, |
| Victoria Yellow O, double, conc., | Milling Scarlet 4RO, |
| Orange No. 4, No. 2, | Fast Red O, |
| Scarlet B extra, | Rosazeine O, G, B, extra, B extra, |
| Fast Acid Blue R, | Acid Rosamine A, |
| Alkaline Blue, all brands, | Fast Acid Violet, all brands, |
| Fast Blue, all brands, | Acid Violet 5BF, 5BFI, N, |
| Half Wool Blue B, | Neutral Violet O, |

Neutral Blue R, 3R,
Milling Blue 2R extra,
Naphthalene Green V. conc.,
Amido Dark Bottle Green B,
Amido Black 3B. A,
Tolyl Black BB. B, BG,

Acid Alizarine Grey G,
Chrome Black B, T,
Amido Black 10BO, A, 3B,
Amido Naphthol Black 4B, 4B
extra, 4BH, 6B, S.

The Direct colours mentioned below may be made faster to milling by an aftertreatment with Bichrome etc.; it is possible therefore to dye rags containing cotton intended for the manufacture of shoddy goods satisfactorily fast to milling, and thus obviate the carbonising process. After dyeing, the goods are treated in a fresh bath at about 195° F. with 2% Bichrome and 1% Acetic acid, for $\frac{1}{2}$ an hour.

The following Dianil colours may be employed according to this method:

Oxydianil Yellow O, G,
Dianil Brown MH,
Dianil Chrome Brown G,
Dianil Fast Brown B,

Dianil Fast Red PH,
Half Wool Black W, T,
Patent Dianil Black FF conc.,
FFC conc.

For shading fast milling colours the following wool dyestuffs are principally to be considered:

Acid Alizarine Yellow RC,
Acid Alizarine Brown B, BB,
Patent Blue A,
Acid Violet 5BF,
Neutral Blue R, 3R,

Half Wool Blue B,
Milling Scarlet 4RO,
Chrome Black B, T, GG,
Acid Alizarine Grey G.

The dyeing of half-wool in a neutral bath is not advisable for materials of a sensitive nature, since the lustre of the goods is liable to be impaired. This difficulty is overcome, however, by using the **Janol colours**. The dyebath is prepared with 30 lbs. of Glauber's salt per 100 lbs. of material and the dyestuff, the goods are entered at 120° F., the bath heated to 195° F., and the material dyed for $\frac{1}{2}$ an hour at this temperature; in case the goods are not sufficiently dyed through, the pieces are worked for some time in the cooling bath.

Janol Scarlet R,
Janol Cardinal B,
Janol Blueish Green B,
Janol Green G,

Janol Olive Green G,
Janol Bronze R,
Janol Copper Red R.

b) Dyeing in an Acid bath with Janus colours.

The Janus colours are of great interest for certain branches of half-wool dyeing, because they possess the property of dyeing wool and cotton alike in an Acid bath.

These dyestuffs have to be dissolved with some care; a solution is best effected by mixing them into a paste with Acetic acid and then adding boiling water.

For light shades the bath is prepared with 3—4% Hydrochloric acid, 2% Fluoride of Chrome, 10% Glauber's salt and the well dissolved colour. The material is entered into the hot dye bath the temperature of which is gradually raised to the boil. In case the wool turns out too light, more Glauber's salt is added to the bath.

Dark shades are dyed in as concentrated a bath as possible, with the addition of 2% Sulphuric acid and the solution of the required dyestuffs. The goods are entered at 158° F., the bath heated to the boil, and the material dyed to shade at this temperature. Through violent boiling the wool is dyed deeper, whilst a lower temperature favours the cotton.

According to their behaviour, the Janus colours may be divided into the following groups:

Janus colours which dye wool and cotton alike.

| | |
|--------------------|-------------------|
| Janus Yellow G, R, | Janus Green G, |
| Janus Red B, | Janus Black O, I. |
| Janus Brown R, | |

Janus colours which dye cotton deeper than wool.

| | |
|----------------|-------------------|
| Janus Brown B, | Janus Grey B, BB. |
|----------------|-------------------|

Janus colours which dye wool deeper than cotton.

| | |
|----------------|------------------|
| Janus Green B, | Janus Blue R, G. |
|----------------|------------------|

Basic and Acid colours which may be used together with Janus colours for the purpose of shading the wool.

| | |
|---------------------------------|---------------------------------|
| Rosazaine O. B, extra, B extra, | Malachite Green crystals extra, |
| Victoria Blue B, | Patent Blue V, |
| Methyl Violet, all brands, | Cyanine B, |
| Brilliant Green crystals extra, | Flavazine T. |

4.

DYEING WITH SULPHUR COLOURS.

A.

Initial covering of the cotton in half-wool and shoddy piece goods.

This can be carried out in two ways, viz., by the Bisulphite process or the Phosphate process. The Bisulphite process which is cheaper, is especially suitable for black, blue and green Thiogene colours, whilst the Phosphate process is used for yellow, orange, brown and violet Thiogene colours. The two processes may also be combined with each other

1. Bisulphite process for Black.

Per 1000 parts of dye liquid, the bath is prepared as follows:

| | |
|----------|----------------------------|
| 25 parts | Sodium Sulphide crystals, |
| 50 " | Thiogene Black liquid M, |
| 28 " | Bisulphite cryst. Hoechst. |

The goods are passed through a roller cistern for 2—4 minutes at about 77° F.; they must be well squeezed as they leave the liquor, and immediately rinsed. The strength of the dyebath is kept constant by gradually adding more of the concentrated stock liquor. The bath must be slightly alkaline and show a violet colour immediately on adding Phenolphthaleine.

2. Bisulphite process for Colours.

(Thiogene Green, Thiogene Cyanine, Thiogene Blue etc.)

The bath is prepared as follows, per 1000 parts of dyeliquor:

| | |
|-----------|------------------------------|
| 7.5 parts | Sodium Sulphide crystals, |
| 5 " | Colour, |
| 5.5—6 " | Bisulphite crystals Hoechst. |

The application is the same as in the previous case. The replenishing liquor is 1½—2 times as strong as the initial dyebath.

3. Phosphate process for Colours.

(Thiogene Orange, Thiogene Yellow, Thiogene Brown, Thiogene Violet and Thiogene Purple.)

1000 parts of dye liquor are made up with:

| | |
|--------------|---|
| 2.5—10 parts | Sodium Sulphide crystals, |
| 5 " | Colour, |
| 50 " | Sodium Phosphate crystals ($\text{Na}_2\text{HPO}_4 + 12\text{H}_2\text{O}$). |

The quantity of Sodium Sulphide varies according to the colour employed.

The goods remain from 2—4 minutes in the bath, at 77° F.; the replenishing liquor contains 1—1½ times as much dye and sodium sulphide as the dye liquor. The quantity of phosphate is the same as that in the dye bath.

4. Combined Bisulphite-Phosphate process for Colours.

This process, which does not injure the wool fibre so much as the Phosphate process, is especially suitable for Thiogene Colours.

Green: Initial bath for 1000 parts dye liquor:

| | |
|------------|------------------------------|
| 10.5 parts | Sodium Sulphide crystals, |
| 6 " | Thiogene Yellow GG, |
| 3 " | Thiogene Green GL extra, |
| 25 " | Sodium Phosphate, |
| 5.25 " | Bisulphite crystals Hoechst. |

The pieces pass through the cistern in 2—4 minutes at about 77° F.; the replenishing liquor contains an equal quantity of Phosphate and 1½—2 times the amount of the other additions.

B.**Production of two colour effects on half wool goods.**

The material is treated for $\frac{1}{2}$ an hour at the boil (on the jigger) with 5% Tannin and 2.5% Zinc Sulphate, or 5% Tannin and 2.5% Tungstate of Soda; it is then squeezed, and without rinsing, dyed cold for 2–4 minutes with Thiogene colours. After squeezing, the goods are immediately washed and cross-dyed with Acid colours.

Tungstate of Soda must be used when dyeing Thiogene Violet, Thiogene Heliotrope and Thiogene Purple; for the other Thiogene colours, either Tungstate of Soda or Zinc Sulphate may be used for the preparatory treatment.

C.**Self shades on half wool piece goods.**

The goods are dyed for 4–5 minutes at 167–176° F., in a roller-cistern. Large quantities of Bisulphite are necessary for this process. The dyebath must be slightly alkaline and show a violet reaction with Phenolphthaleine after 2–5 seconds. After dyeing, the material is immediately rinsed, soured, and again rinsed.

Example: 40–60 parts Sodium Sulphide crystals,
40–60 „ Thiogene Black liquid M,
48–72 „ Bisulphite crystals Hoechst.

The replenishing liquor is double the strength of the dye liquor.

D.**Covering of cotton in loose shoddy.**

This process is especially applicable for Thiogene Black 2BR liquid. The dyebath contains per 1000 parts dye liquor:

20 parts Thiogene Black 2BR liquid,
10 „ Sodium Sulphide crystals,
10–11 „ Bisulphite crystals Hoechst.

The rags are well worked for 20 minutes at about 68° F. squeezed, rinsed and dried. Old baths are replenished in the same proportion as the initial bath.

E.**Covering cotton with Melanogen B and T or Thiogene Brown R, after dyeing the wool.**

This older method is employed for fast milling shades on uncarbonised shoddy, wool wastes etc.

The wool is best dyed with Chrome Developing and Acid colours, and aftertreated with Chrome. After dyeing the wool, the goods are rinsed and the cotton then covered as follows: The bath, which must be as concentrated as possible, is prepared with 50% Glauber's salt, 2% Soda and the requisite amount of dye-tuff. The goods are allowed to remain in the liquor for 3–6 hours at about 68° F. and then rinsed. According to the colour employed, some

Copper Sulphate or Fixing Salt is added to the rinsing bath. The baths are not exhausted and can be used for dyeing further lots.

The methods mentioned under A may also be employed for shoddy goods and for covering burls.

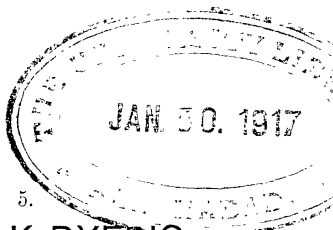
BEHAVIOUR OF HALFWOOL COLOURS TOWARDS HYDROSULPHITE.

The half-wool colours were tested in the same manner as described in the chapter on wool dyeing.

- I. Both wool and cotton become lighter, but a considerable amount of colour still remains on both fibres.
- II. The colour of the wool is partially destroyed, but the cotton still remains fairly dark.
- III. The colour of the cotton is partially destroyed, but the wool still remains fairly dark.
- IV. Both fibres appear dull violet.
- V. The colour is almost, or completely discharged.

| | | | |
|----------------------------------|---|------------------------------|---|
| Aurophenne O | 3 | Dianil Red R | 2 |
| Brilliant Dianil Red R | 3 | Dianil Red 10B | 3 |
| Delta Purpurine 5B | 3 | Dianil Black CR | 2 |
| Dianil Blue B | 5 | Dianil Black R | 2 |
| Dianil Blue BX | 5 | Dianil Black HW | 2 |
| Dianil Blue G | 5 | Dianil Black N | 2 |
| Dianil Blue R | 5 | Dianil Black T | 2 |
| Dianil Blue RR | 5 | Dianil Black PG | 2 |
| Dianil Blue 4R | 5 | Dianil Black PR | 2 |
| Dianil Claret Red B | 2 | Dianil Black E | 5 |
| Dianil Claret Red G | 2 | Dianil Black G | 5 |
| Dianil Brown BD | 5 | Half Wool Black B | 2 |
| Dianil Brown G | 5 | Half Wool Black FB | 2 |
| Dianil Brown 3GO | 5 | Janus Blue G | 4 |
| Dianil Brown R | 5 | Janus Blue R | 4 |
| Dianil Direct Yellow S | 2 | Janus Brown R | 5 |
| Dianil Magenta O | 2 | Janus Yellow G | 3 |
| Dianil Yellow G | 1 | Janus Yellow R | 5 |
| Dianil Yellow 3G | 1 | Janus Grey BB | 4 |
| Dianil Yellow R | 1 | Janus Green B | 4 |
| Dianil Yellow RR | 2 | Janus Green G | 4 |
| Dianil Green G | 5 | Janus Red B | 5 |
| Dianil Orange F2 | 2 | Janus Black I | 4 |
| Dianil Orange G | 2 | Cresotine Yellow G | 5 |
| Dianil Orange N | 3 | Oxydianil Yellow O | 1 |
| Dianil Red 4B | 2 | Toluylene Orange R | 3 |

Half wool, dyed by the three bath method (the wool is acid dyed and then the cotton treated with Basic colours on a Tannin mordant) is stripped as follows: The cotton is bleached cold with Sodium Hypochlorite of 1—1½° Tw.; the goods are rinsed and then worked in a fresh Hydrosulphite AZ or NF Hoechst and Bisulphite bath. After stripping, the goods are thoroughly washed.



5.

HALF SILK DYEING. (GOODS CONSISTING OF SILK AND COTTON.)

The goods are treated in a hot soap bath at 194–203° F. before dyeing, and bleached if necessary.

Hydrogen Peroxide is used as the bleaching agent. To every 10 parts of the commercial product, $\frac{2}{3}$ parts Silicate of Soda of 76 $\frac{1}{2}$ ° Tw are added, and the pieces treated for 4–5 hours in this bleaching bath. They are then thoroughly washed.

For dyeing the goods, winch-becks and jiggers are employed. Closely woven materials which do not easily dye through, are best dyed in the beck; lighter qualities are dyed on the jigger.

Cotton and Silk behave towards colouring matters in some cases very similarly; in other cases they are very dissimilar. A comparison of their behaviour is given in the following remarks.

The dyeing process is carried out in the following manner:

a) Dianil colours.

The dyebath contains per 1000 parts, for light and medium shades:

- 2–3 parts Soap
- 0.1–0.2 parts Soda
- 2–3 parts Sodium Phosphate
- 3–4 parts Salt.

For dark shades the salt is increased to 7 parts per 1000.

The goods are entered at about 122° F., the bath raised slowly to 194° F., and dyeing continued for about $\frac{3}{4}$ of an hour. The goods are then well rinsed and finished off with either Hydrochloric or Acetic acid; if it is necessary to top the shade this is done in the acid finishing bath at 104–122° F.

b) Basic colours.

The goods are mordanted with Tannin and Antimony Salt, rinsed and dyed in a weak acid bath.

c) Thiogene colours.

The Thiogene Blacks are the principal dyestuffs to be considered for dyeing half silk goods; they are used to obtain blacks on material containing white silk effects.

The goods are dyed with 25% Thiogene Black liquid for about 1 hour at 86° F; 30 parts of Bran per 1000 are also added to the dyebath. Unboiled wheat Starch or Wheat Flour give similar results.

For producing two-colour effects, the brands mentioned under No. 4 are very suitable. In order to obtain the silk as white as possible the quantity of soap in the bath is increased, and dyeing carried out at about 122° F. The goods are well rinsed and afterwards dyed with Acid colours at about 104° F. with the addition of Hydrochloric or Acetic acid.

The colours mentioned under 6a are most suitable for dyeing the silk.

1. Colours which dye cotton and silk alike.

| | |
|---------------------|--------------------|
| Aurophenine O, | Janus Yellow R, G, |
| Cresotine Yellow G, | Janus Brown R, |
| Dianil Brown 3GO. | Janus Red B. |

2. Colours which dye the cotton deeper than the silk.

| | |
|-------------------------|-------------------------------|
| Dianil Yellow 2R, 3G, | Dianil Azurine G, |
| Dianil Pure Yellow HS, | Dianil Dark Blue 3R, |
| Dianil Fast Red PH, | Dianil Violet H, |
| Dianil Orange N, | Dianil Brown G, B, BD, M, R, |
| Toluylene Orange R, | D, MH, |
| Delta Purpurine 5B, | Dianil Fast Brown B, |
| Brilliant Dianil Red R, | Dianil Green G, |
| Dianil Red R, 4B, 10B, | Patent Dianil Black FF conc., |
| Dianil Blue 2R, 4R, | Dianil Black CR. |

3. Colours which dye the silk deeper than the cotton.

Dianil Yellow G, R pat.

4. Colours which dye the cotton almost exclusively.

| | |
|-----------------------------|-------------------------------|
| Dianil Direct Yellow S, | Dianil Blue G, B, R, HG, H2G, |
| Oxydianil Yellow O, | H3G, H6G, |
| Dianil Orange G, | Dianil Dark Blue R, |
| Dianil Fast Scarlet GS, RS, | Dianil Black ES. |
| RS extra, 4BS, 6BS, 8BS, | |

5. Colours which dye the silk only, leaving the cotton white.

| | |
|---------------------|--------------------|
| Acid Magenta extra, | Flavazine T, |
| Acid Maroon O, | Flavazine S, |
| Acid Violet 3RS, | Azo Yellow conc., |
| Acid Green conc., | Orange No. 2, |
| Patent Blue V, | Scarlet R, 6R, |
| Naphtol Yellow S, | Victoria Rubine O, |
| | Fast Red S. |

6. Colours used for shading half silk.

a) For Silk.

| | |
|--------------------------|-----------------------------|
| Acid Magenta extra, | Methyl Blue for Silk MLB, |
| Acid Maroon O, | Opal Blue superior soluble, |
| Acid Cerise O, | blue shade, |
| Acid Violet, all brands, | |

| | |
|--|---|
| Silk Blue T, T conc., green shade, 99, KR, | Rosazeine O, B, extra, B extra, 4G, 4G extra, |
| Acid Green conc., | Orange G, No 2, |
| Patent Blue V, A, | Brilliant Orange G, O, R, |
| Violamine, all brands, | Fast Brown O, yellow shade, |
| Fast Blue, all brands, | Scarlet G, R, 6R, B extra, |
| Black Blue O, | Scarlet 6R crystals, |
| Deep Black O, | Brilliant Croceine yellow shade, |
| Fast Dark Blue R, | blue shade, R, B, BB, 3B, 5B, |
| Nigrosine No. 1, No. 4, | Fast Red O, S, |
| Chinoline Yellow O, conc., | Brilliant Crimson O, |
| Naphtol Yellow S, | Amaranth O, |
| Fast Yellow O, S new. | Diamond Scarlet for Silk G, |
| Azo Yellow conc., | Scarlet for Silk O, G, 2G, |
| New Yellow H, | Amido Naphtol Black 4B, 4B |
| Flavazine T, | extra, 6B, S. |
| Flavazine S. | |

† b) For Cotton.

| | |
|---------------------------------|---------------------------------|
| Auramine O, conc., | Methyl Violet, all brands, |
| Phosphine new, | Violet crystals O, |
| Flavophosphine, all brands, | Primula R, B, |
| Methylene Yellow H, | Brilliant Green cryst extra, |
| Chrysoidine A cryst., C cryst., | Malachite Green cryst. extra, |
| C extra crystals, | Safranine conc. |
| Vesuvine conc, 3R superior, | Methylene Viol. RRA, RRN, BN, |
| 4BG conc. extra yellow, | Methylene Blue BB extra, BB |
| Magenta, all brands, | conc., BB, R, 6R, |
| Cerise G, | Methylene Green O, G, GG, 3G, |
| Grenadine O, | extra yellow, ex. yellow conc. |
| Cardinal R, | Methylene Grey O, NFS, |
| Maroon O, | Rosazeine O, B, extra, B extra, |
| New Magenta O, | 4G, 4G extra. |

7. Sulphur colours for solid shades on half silk goods.

The directions given for the dyeing of silk with Thiogene colours are also applicable in this case.

HALF SILK DYEING.

(GOODS CONSISTING OF WOOL AND SILK.)

Three methods must be distinguished:

1. Dyeing the wool, leaving the silk white or as light as possible, so that it may be topped afterwards.
2. Dyeing wool and silk simultaneously.
 - a) in a neutral bath.
 - b) in an acid bath.
 - c) in an alkaline bath.
3. Dyeing and shading of the silk

1. DYEING THE WOOL, LEAVING THE SILK WHITE OR AS LIGHT AS POSSIBLE.

Silk is least affected when the dyeing operation is carried out for about $1\frac{1}{2}$ hours at the boil with the addition of Acetic or Formic acid. Developing colours leave the silk almost unaffected if the goods, after dyeing, are rinsed and developed in a fresh bath. In dark shades the silk is slightly tinted, which cannot be avoided. If the silk effects are to remain white, the material must be passed through a cleansing bath. For this purpose the pieces are treated for 20–30 minutes at $68-104^{\circ}$ F., in a bath containing 3 parts acid Hydrosulphite per 100; they are then rinsed and soured in a cold bath with Sulphuric acid. The Hydrosulphite is prepared by mixing 900 parts of water, 100 parts Bisulphite 57° Tw. and 20 parts Zinc Dust; after allowing the sediment to settle, the clear solution is used.

By topping the silk with light, bright colours, shot effects are obtained. For this purpose Basic and certain Acid colours are most suitable.

a) Acid colours which dye the wool almost exclusively.

The dyebath is prepared with about 10% Acetic acid and the dissolved colour; the goods are entered almost at the boil and boiled for $1-1\frac{1}{2}$ hours; for dark shades the bath may be exhausted by the addition of 1% Sulphuric acid. The goods must be dyed slightly fuller than the pattern and then be passed through a cleansing bath containing 1 part Acetate of Ammonia per 1000. They are treated for about 20 minutes until the silk is sufficiently clear. In many cases a treatment with water at about 140° F. is sufficient.

Naphtol Yellow S,
Flavazine T,
Orange G,
Scarlet 6R,
Scarlet 6R cryst.,
Victoria Scarlet 3R, 4R, 5R, 6R,
New Coccine O,
Amaranth O, E,
Victoria Rubine O,
Naphtol Red O,

Amido Naphtol Red G, 2B, 6B,
Azo Acid Red B, 5B,
Chromotrope 2R, 2B, 6B, 8B,
10B,
Azo Acid Carmine B,
Acid Magenta, all brands,
Acid Violet 3RS, 4RS,
Victoria Violet 4BS, 8BS,
Azo Acid Blue B.

b) Chrome Developing colours which scarcely tint the silk.

The dyebath is prepared with 10% Acetic acid, 10% Glauber's salt and the colour; the goods are entered almost at the boil and boiled for 1 hour: 3% of Bichrome (with Acid Alizarine Blue BB 3% Fluoride of Chrome) are now added, and the shade developed by boiling for a further $\frac{3}{4}$ of an hour. For clearing the silk the previously mentioned method may be employed or, after rinsing well, the goods are passed through a hot soap bath containing about 2 parts of Soap per 1000.

Acid Alizarine Red B,
Chromotrope 6B, 8B, 10B, FB, F4B, DW,
Acid Alizarine Blue BB.

c) Acid wool colours, developed with Copper Sulphate, which leave the silk almost unaffected.

Victoria Rubine O,
Copper Blue B, B extra,
Copper Black S, SB.

2. DYEING THE WOOL AND SILK SIMULTANEOUSLY.

a) in a neutral bath.

Dianil colours are dyed in a neutral bath; at the boil the wool is dyed deeper, but at a lower temperature the silk is dyed fuller.

For dark shades the dye bath is prepared with about 30%, for light shades about 10% of Glauber's salt. The dyeing operation is first carried out at the boil; if the silk is too light the bath is allowed to cool down, or some more of a colour which favours the silk is added.

Dianil Pure Yellow HS,
Dianil Orange 3G, R, 2R,
Dianil Orange 4R,
Dianil Brown 3GO, R, BD,
Dianil Chrome Brown G, R,
Dianil Red 4B,
Dianil Fast Red PH,

Dianil Claret Red G, B,
Dianil Blue G, B, R, 2R, 3R,
4R, HG, H2G, H3G, H6G,
Half Wool Blue BD,
Dianil Black CR, N, R,
Patent Dianil Black EB conc.,
EF conc.

b) in an acid bath.

In order to obtain exactly the same shade on wool and silk 10% Glauber's salt and 4–6% Sulphuric acid, for Resorcine colours

10% Acetic acid, are added. In case the silk is too light, the bath is cooled to about 140° F., and some more colour added. Such Basic colours as dye the silk exclusively in an acid bath may also be added.

| | |
|-----------------------------------|--------------------------------|
| Azo Yellow O, conc., | Acid Violet N, 5BF, 5BFI, 7BN |
| Victoria Yellow O, double, conc., | Neutral Blue R, 3R, |
| Orange No. 2, No. 4, 4LL, RR, | Blue de Lyon, all brands, |
| Brilliant Croceine, all brands, | Soluble Blue, all brands, |
| Fast Red O, | Opal Blue, all brands, |
| Scarlet M new, B extra, | Silk Blue, all brands, |
| Eosine, all brands, | Patent Blue V, N, Superior, L, |
| Erythrosine, all brands, | LL, B, G conc., A, |
| Phloxine, all brands, | Milling Blue 2R extra, |
| Rose Bengale, all brands, | Fast Acid Blue R, R conc., |
| Rosazeine O, B, extra, B extra, | Fast Blue, all brands, |
| Acid Rosamine A, | Fast Dark Blue R, |
| Fast Acid Magenta G, G conc., | Silk Wool Black 3B, T. |
| Fast Acid Violet, all brands, | |

DYEING WOOL AND SILK FAST TO MILLING.

Silk contained in shoddy goods must be dyed fast to milling, because it is not destroyed by the carbonising process. For this purpose Acid Alizarine Black SE is very suitable. Since the iron salts usually contained in shoddy impair the shade of Acid Alizarine Black, it is advisable to use 1–2% of Oxalic acid, Sulphuric acid being finally added to exhaust the bath; the shade is then developed with chrome in the usual manner.

c) in an alkaline bath.

Alkaline Blues are dyed with Borax and Soap, or Sodium Phosphate and Soap, then well rinsed and developed in a fresh warm bath with Sulphuric acid. Alkaline Blues cover both the wool and the silk.

3. DYEING AND SHADING OF THE SILK.

a) Colours for dyeing the silk.

The following colours leave the wool undyed in a cold acid bath and are used for dyeing silk for shot effects:

| | |
|---------------------------------|-----------------------------|
| Auramine O, I, II, conc., | Acid Violet 3RS, 4RS, 7BN, |
| Janus Yellow G, R, | Safranine, all brands, |
| Janus Brown R, B, | Methylene Violet 2RA, 3RA, |
| Janus Red B, | Methylene Heliotrope O, |
| Rosazeine O, B, extra, B extra, | Rosolane O, T, |
| 4G, 4G extra, | Methylene Blue all brands, |
| Fast Acid Eosine G, | Methyl Blue for Cotton MLB, |
| Fast Acid Phloxine A, | Janus Blue G, R. |

| | |
|---------------------------------|--------------------------------|
| Fast Acid Magenta G, G conc., | Pure Blue, all brands, |
| Violamine, all brands, | Silk Blue, all brands, |
| Brilliant Croceine, all brands, | Methylene Green, extra yellow, |
| Scarlet 5R, | Janus Green G, B, |
| Victoria Rubine O, | Naphtalene Green V conc. |
| Naphtol Red O, | Janus Grey B, 2B, |
| Amaranth O, E, | Janus Black O, I, II. |
| Acid Magenta, all brands, | |

b) Colours for shading the silk.

The following Basic colours dye practically only the silk in a hot acid bath, and can therefore be used for shading the silk when dyeing solid shades on silk-wool material:

| | |
|---------------------------------|------------------------------|
| Chrysoidine A cryst., C cryst., | Magenta, all brands, |
| Vesuvine, all brands, | New Magenta O, |
| Azophosphine GO, | Methyl Violet, all brands, |
| Brilliant Green, all brands, | Safranine, all brands, |
| Malachite Green, all brands, | MethyleneViolet2RA, 3RA, BN, |
| Methylene Blue, all brands, | Methylene Heliotrope O. |
| Methylene Green, all brands, | |

WOOL PRINTING.

A. PIECE GOODS.

Before printing, the pieces are passed through the following processes:

- 1 Cleansing.
- 2 Bleaching.
3. Chlorinating, and in special cases
4. Treating with Stannates.

1. CLEANSING.

The goods are passed at full width and under tension through water at 176° F., and are then allowed to lie for some time "batched" up (rolled). According to the texture of the goods this process may be repeated, the object being to "set" the fibres. The pieces are then treated at 100–110° F. in a soap bath containing some Soda or Ammonia, well washed in water which is free from Lime and finally squeezed or hydroextracted.

2. BLEACHING.

Bleaching with Sulphur is carried out by means of gaseous Sulphur Dioxide (chamber bleach) or by the wet method (Bisulphite process). In chamber-bleaching the moist pieces are hung over-night in an atmosphere of Sulphur Dioxide, generated by burning Sulphur, or special machines are used through which the goods are passed continuously at full width.

In the Bisulphite process the pieces are treated with Sodium Bisulphite, with or without the addition of acid. The clean, well-squeezed pieces (50 pieces of 50 yards each) are allowed to lie over-night in a cistern containing 4.0 gallons of water, 30–35 lbs. Bisulphite crystals (Hoechst) and 5–7 pints concentrated Sulphuric acid; they are then well washed and chlorinated. Or the pieces are padded with Bisulphite solution 18–22° Tw., batched, and allowed to stand for a day, passed through dilute Sulphuric acid, washed and chlorinated.

Other Bleaching processes are the following:

The goods are padded with a solution of Bisulphite crystals (1:3), steamed for 5 minutes, washed and squeezed.

Hydrosulphite NF conc. Hoechst (the Formaldehyde-Hydrosulphite compound) may also be used for bleaching wool. The

Hydrosulphite NF conc. is either added to a weak Bisulphite bath, when the bleaching constituent of the former is set free, or the goods are padded with a solution of Hydrosulphite NF conc. ($1\frac{3}{4}$ —4 oz. per gall.) (10—25 grammes per Litre) then dried and steamed for a short time. It appears that the Hydrosulphite white is more stable and faster to steaming than the Sulphur white.

Hydrogen Peroxide is also used for bleaching wool.

3. CHLORINATING.

This treatment with Chlorine affects the results considerably: the depth and brightness of the shade and the evenness of the printed colour depend very largely upon it.

Wool pieces are chlorinated either with Chloride of Lime solution and Hydrochloric acid, or with Sodium Hypochlorite and Hydrochloric, or better still, Sulphuric acid. In order always to obtain the same results, the chlorinating baths and also the stock solution of Hypochlorite should be titrated. It may serve as a guide to state that a piece of muslin de laine 130 yards (120 metres) long and about 16 lbs. ($7\frac{1}{2}$ kilos) weight, intended for heavy blotch printing, requires about 4— $5\frac{1}{2}$ ozs. (120—160 grammes) active Chlorine, while floral patterns require only one third to one half of this amount.

When properly carried out, chlorination increases the affinity of the wool for the colour, without causing the white to become yellow during steaming.

The chlorination is carried out at full width in a wooden trough provided with a number of porcelain rollers (latterly lead-lined cisterns or special machines constructed of Chlorine-resisting material have been used). An exhaust appliance is fixed above each trough for carrying away the chlorine fumes.

According to the strength of the Chloride of Lime solution, the goods are passed once or twice through the liquor, each passage lasting 40—50 seconds; they are then washed until Congo paper is no longer affected.

The chlorinating baths are made up as follows:

Initial bath

| | | |
|--------|-----------|------------------------------|
| 1000 l | 200 gall. | Cold water |
| 5 l | 1 | „ Sulphuric acid 168° Tw. |
| 25 l | 5 | „ Sodium Hypochlorite 9° Tw. |

or

| | | |
|--------|----------------|-----------------------------|
| 600 l | 120 gall. | Cold Water |
| 8 l | $1\frac{3}{8}$ | „ Chloride of Lime 12° Tw. |
| 13.5 l | $2\frac{1}{4}$ | „ Hydrochloric acid 12° Tw. |

For a piece of muslin delaine 130 yards (120 metres) long of 16 lbs. ($7\frac{1}{2}$ kg) weight, the bath is renewed with:

| | | |
|-------|-------------------------------------|----------------------------|
| 6—8 l | $1\frac{1}{5}$ $1\frac{3}{5}$ gall. | Sodium Hypochlorite 9° Tw. |
| 6—8 l | $1\frac{1}{5}$ — $1\frac{3}{5}$ | „ Sulphuric acid 9° Tw. |

or

| | | |
|---------|------------------------|-----------------------------|
| 4—4.5 l | $\frac{4}{5}$ —1 gall. | Chloride of Lime 12° Tw. |
| 4 l | $\frac{4}{5}$ | „ Hydrochloric acid 12° Tw. |

Before passing through the chlorinating bath the material must be well wetted out and squeezed.

A treatment with Tin compounds sometimes follows the chlorination. The goods are passed through a solution of Stannate of Soda $4\frac{1}{2}$ - 9° Tw., batched for a short time and then passed through a fixing bath of Sulphuric acid $1\frac{1}{2}^{\circ}$ Tw.; they are then thoroughly washed and dried.

In order that the white may remain unaffected in steaming, the goods are passed through a bath containing 10-20 parts Stannate of Soda per 1000 parts, and dried without being soured.

A treatment with Bisulphite of 12-15° Tw. may also be carried out after the chlorination; the goods are then washed and passed through a liquor containing Hydrogen Peroxide and Silicate of Soda, which acts as a bleaching bath and at the same time removes the sulphurous acid from the wool fibre.

The composition of the bath is as follows:

| | | |
|-----------|-------------------|----------------------------|
| 24 litres | 5 gall. | Hydrogen Peroxyde 10 Vols. |
| 6 „ | 1 $\frac{1}{4}$ „ | Sil cate of Soda 32° Tw. |
| 70 „ | 14 „ | Water. |

The goods are padded with this solution, allowed to lie rolled up for 12 hours and then well washed.

Finally, it may be pointed out that very hard water must not be used for washing wool pieces because this tends to make the wool yellow in steaming, especially if the pieces are washed rather too long.

Two methods are generally employed in wool printing:

- I. Direct Printing.
- II. Discharge and Resist Printing.

I. DIRECT PRINTING.

The direct printing of woollen pieces is carried out either by hand or machine. Hand or block-printing is carried out disconnectedly, but by selecting suitable dyestuffs and special printing colours it is possible to work so that the places where the colours overlap are not observable.

Machine printing is carried out continuously (Rouleaux) or on machines which work intermittently as in block printing. Since no overlapping occurs in the Rouleaux machines, the colours used for this purpose need not equalise as well as colours used for block printing; therefore nearly all wool colours are suitable for machine printing.

a. Machine Printing.

For heavy patterns the rollers must be deeply engraved and the cylinder properly wrapped. To fix the colours properly it is necessary that the steam and the goods also, or at least the printed

places, are somewhat moist. As the goods leave the printing machine they are wrapped in end cloths; or they are slightly dried and then hung in a cool, damp room, or again wrapped in moist cloths. The degree of moisture in the end cloths is ascertained by their weight. Damping machines are also very serviceable.

Steaming is generally carried out without pressure in wooden, iron or brick steam boxes, and great care must be taken that the steam enters the apparatus moist. This end is obtained by passing the steam through a moistening apparatus (an iron cylinder partly filled with water), or through a water tank attached to the bottom of the steam box. The more moisture present in steaming, the brighter and fuller are the resulting shades. To judge the steam pressure each steam box ought to be provided with a water gauge, and the pressure ought never to rise above 10–20 cm. It is advisable to enclose the steaming apparatus with wood.

White ground patterns must be steamed for as short a time as possible, in order to prevent the wool from turning yellow; therefore such dyestuffs must be chosen for printing as are fixed with a minimum amount of steaming.

After steaming, the pieces are rinsed, if possible in running water. If only soft and rather warm water (in summer) is obtainable, it is advisable to add certain salts (common salt, Glauber's salt etc.) to it, in order to prevent bleeding.

In order to produce a good finish, the printed muslins are often treated, after washing and drying, with a clear solution of Gum or Tragacanth, then dried on the stretching frame, again moistened with water and pressed. Sometimes the handle of the goods is improved by decatizing after printing and steaming thick materials such as flannel covers etc. are washed, stoved, again washed, soaped and then rinsed.

b) Hand Printing.

The results obtained by hand printing depend on the quality of the cloth, bleaching and preparing, partly also on the thickening and the ability of the printer etc., and finally and mainly on the proper selection of suitable dyestuffs.

The less affinity a certain colour possesses for the wool fibre at the ordinary temperature the more level results will this colour generally produce.

Besides hygroscopic substances, e. g. Glycerine, which assist the equalising properties of a colour, other additions are made which cause a partial lake formation in the printing colour itself and thus retard the dyeing. Such substances are: Sodium Tungstate, Sodium Phosphate (generally in combination with Chloride of Tin) or Tin Crystals and Bisulphite. Solidogen A or Rodogen may also be used as additions to the printing paste. Turkey Red Oil and Monopole Soap are also good assistants; in certain cases Phenol may be employed with advantage. Tannic acid reduces the affinity of Acid

colours for the wool fibre and may therefore be employed for the production of blotches; up to 20 gms. of Tannic acid per kilo printing colour (5 drams per 1 lb.) are added. Small quantities of Ammonia also facilitate the equalising, whilst additions of Tin salts increase the fastness to washing of the prints (See recipes.)

The thickening agent employed and the consistency of the printing colour also play a great part in hand printing. For light and medium floral and conventional designs, gum thickenings are employed; thickenings containing Dextrine also equalise easily.

For dark brown, blue and black blotches, British Gum is used, or British Gum in combination with Tragacanth or Starch.

The steaming, washing and finishing of hand-printed goods are carried out in the manner described for machine printed goods.

PRINTING PASTES FOR DIRECT PRINTS.

The printing pastes contain dyestuff, solvent, thickening and different additions which act partly as equalising agents and partly as mordants, or facilitate the combination of the colouring matter and the wool fibre.

The following ingredients are employed as solvents: Water, Acetic and Formic acids, Spirit, Wood Spirit, Acetone etc. Thickening agents are Gum, British Gum, Artificial Gum, Dextrine, Burnt Starch, Wheat Starch, Tragacanth and more seldom Carrageen Moss. The thickening agents must be so chosen that they can be easily removed by washing in water and they must on no account be liable to turn the fibre brown. For dark shades a portion of the thickening agent may be replaced by China Clay, whereby better fixation is obtained and the work done more economically.

Most wool dyestuffs combine directly with the wool fibre, i. e. they do not require a mordant for fixation.

The fixing agents for wool are Chrome, Tin and Alumina mordants or Tannin, which form colour lakes or auxiliary mordants which favourably influence the dyeing of the wool fibre and improve the equalising properties of colours which equalise badly.

As auxiliary mordants may be employed, Acids, Acid Salts, (Alum, Chloride of Tin etc.) or Salts of Ammonia, which decompose on steaming, liberating acids, such as Acetate and Oxalate of Ammonia. These acid ingredients are used for the fixation of Acid colours. The stronger Sulphuric and Oxalic acids act better than the weaker Acetic and Formic acids. When using stable acids, especially Sulphuric acid, the printing blankets and end cloths must be impregnated with Soda.

Weak alkaline salts such as Sodium Phosphate, serve for the fixation of Direct colours; Sodium Chlorate is added to dark printing colours, and especially to black, in order to counteract any tendency to reduction.

Glycerine is sometimes added to improve the equalising properties and to make the printing colour hygroscopic. For light-shades it is advisable to add a slight excess of Ammonia to the printing colour, when more even results are obtained.

For muslin delaine and flannel, very bright equalising colours are used, and the requirements as to fastness to light and washing are only slight.

For goods which are subsequently stoved and raised in a wet state, colours must be employed which are fast to stoving and bleeding. For flag materials, colours fast to light and water are required, and for carpet goods fastness to light is the chief requirement.

For fur imitations, which are exposed to high pressure for a considerable time, the fastness to steam must also be taken into consideration when selecting the dyes-uffs.

Certain colours decompose and sublime with a yellow colour onto the white during steaming, especially when exposed to dry steam. At the end of this chapter a list of colours fast to steaming is appended.

The following series of colours may be employed in direct printing: Basic, Resorcine, Acid, Mordant and Dianil colours.

The printing recipes vary according to the dyestuff employed.

1. Basic Colours.

When working with Basic colours the printing colour is made slightly acid with Acetic or other organic acids. Basic colours are very often employed in cases where the goods have not been chlorinated or where they have been treated only slightly with Chlorine. By the addition of Tannic acid to the printing colour the fastness to washing, and in some cases the fastness to light also, is increased. The Basic colours are especially employed in hand printing in combination with Acid colours or Dyewood extracts, e. g. for dark brown shades.

The following printing recipes are suitable for Methylene Blue, Thioene Blue GO, New Methylene Blue N, New Fast Blue 3R crystals, Methylene Grey, Methylene Green, Methylene Heliotrope.

| | I. | II. |
|-----------------------------|------------|------------|
| Colour | 20 parts | 20 parts |
| Water | 560 " | 480 " |
| Acetic acid 50% | 100 " | 100 " |
| British Gum powder | 300 " | 300 " |
| Tartaric acid | 20 " | 20 " |
| Acetic acid-tannin sol. 1:1 | — | 80 " |
| | 1000 parts | 1000 parts |

2. Resorcine Colours.

These may be employed in a weak acid, neutral or weak alkaline printing paste, to which are added Sodium Acetate, Sodium Phosphate, Soda, Ammonia, Ammonium Oxalate and Tin salts; the latter addition produces fuller shades.

The Resorcine colours are fixed by steaming for a short time in the Mather-Platt, and in spite of their poor fastness to light, are used for producing bright pink and red shades in floral and conventional designs, both in hand and machine printing.

The Resorcine colours withstand reducing agents fairly well and may be employed for coloured discharges; the fastness to stoving is satisfactory.

Printing Recipes for Resorcine Colours.

| | I. | II. | III. | IV. |
|------------------------|------------|------------|------------|------------|
| Colour | 20 parts | 20 parts | 20 parts | 20 parts |
| Boiling Water | 200 " | 270 " | 250 " | 220 " |
| Senegal Gum Thickening | 700 " | — | 700 " | 700 " |
| British Gum sol. 1.2 | — | 600 " | — | — |
| Ammonia | — | — | — | 20 " |
| Glycerine | 20 " | 50 " | 20 " | 20 " |
| Tin salts Ia crystals | 20 " | 20 " | — | — |
| Phosphate of Soda | 40 " | — | — | — |
| Soda | — | — | 5—10 " | — |
| Oxalate of Ammonia | — | — | — | 20 " |
| Acetate of Soda cryst. | — | 40 " | — | — |
| | 1000 parts | 1000 parts | 1000 parts | 1000 parts |

The following colours are printed according to the above recipes: Uranine O, Eosine, Erythrosine, Phloxine, Rose Bengale, Rosazeine. The addition of Tin salts yields more brilliant and yellower shades, which bleed but slightly, whilst the addition of Soda produces bluer shades. Since the Eosine colours equalise well, they may also be employed in hand printing, according to printing recipes I and II (page 209).

3. Acid Colours.

These colours are generally printed as acid pastes; only in special cases are they printed neutral or slightly alkaline. As acid additions the following ingredients are employed: Acetic, Sulphuric, Tartaric, Oxalic and Citric acids and their Ammonium salts, also Alum, Aluminium Sulphate and Tin Chloride. To colours which are dissolved with difficulty or which print badly, neutral salts, salts which split up in steaming (Ammonium, Oxalate etc.) or weak alkaline compounds should be added. The equalising properties of mixed printing pastes are often favourably influenced by small additions of Ammonia.

Additions of Tannic acid increase the equalising power and fastness to washing of many Acid colours, but on the other hand, alkaline substances diminish the fastness to water of certain colours. When working with these colours, the use of alkalis, soaps etc. must be avoided as much as possible. If an alkaline treatment is unavoidable, the goods are finally passed through a weak acid bath.

Acid colours are printed according to the following recipes.

Recipe 1.

| | | |
|-------------------------|------------|---|
| Colour | 30 parts | } Chinoline Yellow, Flavazine, Fast Yellow, Milling Yellow, Orange, Chromotrope (may also be printed in dark shades according to Recipe 2). |
| Boiling Water | 230 " | |
| Senegal Gum thickening. | 700 " | |
| Oxalic acid | 20 " | |
| Glycerine | 20 " | |
| | 1000 parts | |

Recipe 2.

| | | |
|---------------|------------|--|
| Colour | 30 parts | } Scarlet, Victoria Scarlet, Nassovia Scarlet, New Coc- cine, Victoria Rubine, Scarlet 6R crystals, Brilliant Crim- son, Amido Naphtol Red, Azo Acid Red B, Chromo- trope. |
| Boiling Water | 670 " | |
| British Gum | 250 " | |
| Oxalic acid | 20 " | |
| Alum | 10 " | |
| Glycerine | 20 " | |
| | 1000 parts | |

Recipe 3.

| | | |
|---------------|------------|--|
| Colour | 30 parts | } Acid Magenta, Acid Violet, Victoria Blue B, Fast Acid Blue R, Azo Acid Blue. |
| Water | 670 " | |
| British Gum | 250 " | |
| Oxalic acid | 20 " | |
| Tartaric acid | 10 " | |
| Glycerine | 20 " | |
| | 1000 parts | |

Recipe 4.

| | | |
|--------------------|------------|---|
| Colour | 30 parts | } Patent Blue, Cyanine B, Acid Green, Naphtalene Green, Naphtalene Blue, Milling Blue. |
| Water | 670 " | |
| British Gum | 250 " | |
| Oxalate of Ammonia | 20 " | |
| Oxalic acid | 10 " | |
| Glycerine | 20 " | |
| | 1000 parts | |

Recipe 5.

| | | |
|--------------------|------------|---|
| Colour | 30 parts | } Alkaline Blue, Conc. Cotton Blue R, Methyl Alkaline Blue etc. |
| Water | 625 " | |
| Ammonia | 50 " | |
| British Gum | 250 " | |
| Glycerine | 20 " | |
| Oxalate of Ammonia | 25 " | |
| | 1000 parts | |

Recipe 6.

| | | |
|--------------------|------------|------------------------|
| Colour | 40 parts | } Fast Blue, Induline. |
| Water | 620 " | |
| Ammonia | 50 " | |
| British Gum | 250 " | |
| Glycerine | 20 " | |
| Oxalate of Ammonia | 20 " | |
| | 1000 parts | |

Recipe 7

| | | |
|-----------------|-------------|--|
| Colour | 50-70 parts | } All Azo Acid Black brands and Carbon Black GAT. |
| Boiling Water | 630 " | |
| British Gum | 250 " | |
| Oxalic acid | 30 " | |
| Glycerine | 20 " | |
| Sodium Chlorate | 5 " | |
| <hr/> | | |
| 1000 parts | | |

NOTE: The following good equalising colours are especially suitable for hand-printing:

Flavazine T, Flavazine, Chinoline Yellow, Orange, New Coccine, Victoria Scarlet, Victoria Rubine, Amaranth, Patent Blue, Naphthalene Blue, Naphthalene Green, Fast Acid Violet, Fast Acid Blue, Fast Blue, Induline 2N, Azo Acid Black, Acid Magenta, Silk Wool Black and Carbon Black GAT, Scarlet, Azo Acid Magenta, Amido Naphtol Red.

These dyestuffs are printed according to the following recipes. Recipe No. III is particularly recommended for floral and conventional designs.

| | I | II | III. | IV. | |
|-----------------------------|---------|---------|---------|---------|-------|
| Colour | 20-50 | 20-50 | 20-50 | 20-50 | parts |
| Water | 350-320 | 370-340 | 295-265 | 310-270 | " |
| Ammonia | 50 | — | 50 | — | " |
| Gum Sol. 1:2 | 500 | 500 | 500 | 500 | " |
| Glycerine | 50 | 50 | 50 | 50 | " |
| Oxalate of Ammonia | 30 | — | 30 | 30 | " |
| Aqueous Tannin solution 1:5 | — | 60 | — | — | " |
| Turkey Red Oil | — | — | 40 | — | " |
| Monopole Soap | — | — | — | 30 | " |
| Turpentine | — | — | 15 | — | " |
| | 1000 | 1000 | 1000 | 1000 | parts |

4. Mordant Colours.

These are employed for prints fast to washing and light. The printing pastes are prepared with the addition of Acetic acid, Oxalic acid or other stable organic acids, and metallic mordants such as Fluoride of Chrome, Acetate of Chrome, Aluminium and Tin compounds etc.

After printing, the colours are fixed by steaming for 1-2 hours. Some Mordant colours, e.g. the Alizarine Yellow brands, and also the Alizarine Direct Blues, Alizarine Direct Violet, Alizarine Direct Green, produce sufficiently fast prints without a mordant.

Since gum thickenings, in the presence of Chrome mordants, impart a harsh handle to the wool, British Gum or Burnt Starch must be used for preparing the printing pastes. The soft handle can be restored by washing, maling or soaping.

The following are recipes for printing with Mordant colours:

Alumina Printing Colour.

| | | |
|---------------------|------------|---|
| Colour | 30 parts | } This recipe is suitable for all Alizarine Sulphonic acids (S. brands), Alizarine Orange, Alizarine Claret; when using the paste brands, the amount of dyestuff must be correspondingly increased. |
| Water | 280 " | |
| Glycerine | 30 " | |
| British Gum | | |
| Thickening 1:1 | 600 " | |
| Tarraric acid | 20 " | |
| Sulphate of Alumina | 40 " | |
| | 1000 parts | |

Chrome Printing Colour I.

| | | |
|-------------------|------------|---|
| Colour | 30 parts | } All Alizarine Sulphonic acids, Alizarine Yellow brands and Alizarine Brown. |
| Water | 330 " | |
| British Gum | | |
| Thickening 1:1 | 500 " | |
| Glycerine | 20 " | |
| Acetic acid 50% | 50 " | |
| Tartaric acid | 20 " | |
| Acetate of Chrome | | |
| 32° Tw. | 50 " | |
| | 1000 parts | |

Chrome Printing Colour II.

| | | |
|-------------------|------------|---|
| Colour | 50 parts | } All Alizarine Blue Bisulphite and Ceruleine Bisulphite brands (S. brands). When using paste dyestuffs the amount of colour must be correspondingly increased. |
| Water | 330 " | |
| British Gum | | |
| Thickening 1:1 | 500 " | |
| Acetate of Chrome | | |
| 32° Tw. | 80 " | |
| Glycerine | 20 " | |
| Oxalic Acid | 20 " | |
| | 1000 parts | |

Chrome Printing Colour III.

| | | |
|--------------------|------------|---|
| Colour (in paste) | 100 parts | } This is not suitable for Bisulphite paste brands of Alizarine Blue and Ceruleine. |
| Water | 275 " | |
| British Gum | | |
| Thickening 1:1 | 500 " | |
| Formic acid conc. | 50 " | |
| Glycerine | 30 " | |
| Fluoride of Chrome | 20 " | |
| Water | 5 " | |
| Oxalic acid | 20 " | |
| | 1000 parts | |

For Acid Alizarine colours, which must be printed with large quantities of Chrome mordant, the following recipes are used:

| | I. | II. | III. | IV. | V. |
|---------------------------|------|------|------|------|------------|
| Colour | 50 | 50 | 50 | 50 | 30 parts |
| Water | 505 | 455 | 590 | 540 | 650 „ |
| Ammonia | — | 50 | — | 50 | — |
| British Gum powder | 250 | 250 | 250 | 250 | 250 „ |
| Acetic Acid 50% | 25 | 25 | 25 | 25 | — |
| Oxalic acid | 20 | 20 | 20 | 20 | 20 „ |
| Acetate of Chrome 32° Tw. | 150 | 150 | — | — | — |
| { Fluoride of Chrome | — | — | 50 | 50 | 40 „ |
| { Water | — | — | 15 | 15 | 10 „ |
| | 1000 | 1000 | 1000 | 1000 | 1000 parts |

| | | |
|---------------------|-----|--|
| According to Method | I | Acid Alizarine Brown, |
| „ „ „ | II | Acid Alizarine Yellow RC, Acid Alizarine Red, |
| „ „ „ | III | Acid Alizarine Brown, Acid Alizarine Black, |
| „ „ „ | IV | Acid Alizarine Grenade R, Acid Alizarine Dark Blue SN, Acid Alizarine Grey G, Fast Mordant Blue, Acid Alizarine Blue BB, |
| „ „ „ | V | Alizarine Direct Blue, Alizarine Direct Green. |

Acid Alizarine Green is dissolved with the double amount of Ammonia and printed according to Method III.

5. Dianil Colours.

The Dianil colours surpass the Acid colours as regards fastness to washing and water, and although the shades produced with them lack brightness, still they are used for many classes of goods, especially for raised materials. The fastness to light and stoving of these colours is satisfactory. For fixing the Dianil colours, the following ingredients are used: Sodium Phosphate, Borax, Acetic acid, Acetate of Ammonia and Tartaric acid.

Three recipes are generally suitable for the preparation of the printing pastes:

| | I. | II. | III. |
|-------------------|------------|------------|------------------|
| Colour | 30 parts | 30 parts | 30 parts |
| Water | 670 „ | 680 „ | 680 „ |
| British Gum | 250 „ | 250 „ | 250 „ |
| Glycerine | | | |
| dissolve and add | 20 „ | 20 „ | 20 „ |
| Phosphate of Soda | 30 „ | 20 Borax | 20 Tartaric Acid |
| | 1000 parts | 1000 parts | 1000 parts |

Dianil Yellow, Dianil Direct Yellow S, Cresotine Yellow, Aurophenine, Oxydianil Yellow, Dianil Orange, Toluylene Orange, Dianil Pink, Dianil Crimson, Dianil Brown, Dianil Red, Brilliant Dianil Red, Dianil Scarlet, Dianil Violet H, Dianil Blue, Dianil Indigo, Dianil Dark Blue, Dianil Green, Dianil Dark Green, Half Wool Black EBS for printing, Dianil Black T, E, N, G, EB.

RECIPES FOR WOOL PRINTING.

A. Yellow and Orange.

| | | |
|------------------------|------------------|--|
| 1. Flavazine T | 30 parts | } for Flavazine T, S. Chinoline Yellow O (extra), Fast Yellow O, Milling Yellow O, Orange No. 2, RR, R. |
| Boiling Water | 230 .. | |
| Gum Sol. 1:1 | 700 .. | |
| Oxalic Acid cr. | 20 .. | |
| Glycerine | 20 .. | |
| | <hr/> 1000 parts | |
| 2. Auramine O | 10 parts | } for brilliant Yellow shades in hand-printing. |
| Senegal Gum 1:1 | 500 .. | |
| Water | 410 .. | |
| Glycerine | 20 .. | |
| Tin Salts | 20 .. | |
| Acetate of Soda cryst. | 40 .. | |
| | <hr/> 1000 parts | |
| 3. Aurophenine O | 30 parts | } for all the brands of Dianil Yellow and Dianil Orange. |
| Water | 680 .. | |
| British Gum | 250 .. | |
| Glycerine | 20 .. | |
| Phosphate of Soda | 20 .. | |
| | <hr/> 1000 parts | |

B. Pink, Red and Claret.

| | | |
|--------------------|------------------|---|
| 4. Eosine extra | 10 parts | } for all Eosine colours, also Rosazeine and Uranine in hand-printing. |
| Water | 410 .. | |
| Gum Sol. 1:1 | 500 .. | |
| Glycerine | 20 .. | |
| Tin Salts | 20 .. | |
| Acetate of Soda | 40 .. | |
| | <hr/> 1000 parts | |
| 5. Rosazeine O | 20 parts | } for all Rosazeine brands. |
| Boiling Water | 240 .. | |
| Senegal Gum 1:2 | 700 .. | |
| Glycerine | 20 .. | |
| Oxalate of Ammonia | 20 .. | |
| | <hr/> 1000 parts | |
| 6. Scarlet 3R | 20 parts | } in hand-printing for the red Azo colours and also for Eosines. |
| Water | 330 .. | |
| Ammonia | 50 .. | |
| Gum Sol. 1:2 | 500 .. | |
| Glycerine | 30 .. | |
| Oxalate of Ammonia | 30 .. | |
| Turkey Red Oil 50% | 40 .. | |
| | <hr/> 1000 parts | |

| | | |
|---------------|-------------------|--|
| 7. Scarlet 3R | 30 parts | } for all Scarlet brands, Scarlet 3R crystals, Victoria Scar- let brands, New Coccine O, Brilliant Crimson brands, Naphtol Red. |
| Boiling Water | 670 " | |
| British Gum | 250 " | |
| Oxalic acid | 20 " | |
| Alum | 10 " | |
| Glycerine | 20 " | |
| | <u>1000 parts</u> | |

For shading the reds Rosazaine and New Discharge Red are used

| | | |
|---------------------|----------------------------------|-------------------|
| 8. New Coccine O | 30 parts | — |
| Rosazaine O | 10 " | — |
| Scarlet 3R | — | 32 parts |
| New Discharge Red B | — | 8 " |
| Ammonia | 10 " | 10 " |
| Boiling Water | 600 " | 600 " |
| British Gum | 300 " | 300 " |
| Oxalic acid | 20 " | 20 " |
| Alum | 10 " | 10 " |
| Glycerine | 20 " | 20 " |
| | <u>and make up to 1000 parts</u> | <u>1000 parts</u> |

Brilliant Scarlet shades are obtained by mixing Rosazaine with
Chinoline Yellow or Flavazine S.

| | | |
|----------------------|----------------------------------|-------------------|
| 9. Rosazaine B extra | 8 parts | 8 parts |
| Chinoline Yellow O | 16 " | — |
| Flavazine S | — | 10 " |
| Water | 321 " | 327 " |
| Ammonia | 10 " | 10 " |
| Gum Sol. 1:1 | 600 " | 600 " |
| Glycerine | 20 " | 20 " |
| Oxalate of Ammonia | 25 " | 25 " |
| | <u>and make up to 1000 parts</u> | <u>1000 parts</u> |

| | | |
|-----------------------|-------------------|---------------------------------------|
| 10. Alizarine Red IWS | 30 parts | } for Alizarine Red IWS and PS. |
| Water | 280 " | |
| Glycerine | 30 " | |
| British Gum | — | |
| thickening 1:1 | 600 " | |
| Tartaric acid | 20 " | |
| Sulphate of Alumina | 40 " | |
| | <u>1000 parts</u> | |

| | | |
|----------------------------|-------------------|----------------------------------|
| 11. Brilliant Dianil Red R | 30 parts | } for the red Dianil colours. |
| Water | 680 " | |
| British Gum | 250 " | |
| Glycerine | 20 " | |
| Phosphate of Soda | 20 " | |
| | <u>1000 parts</u> | |

C. Brown and Fancy shades.

| | | | |
|---------------------------|------------|--------------------|--|
| 12. and 13. Acid Violet N | 18 parts | 15 parts | |
| Orange No. 2 | 21 " | 23 " | |
| Patent Blue V | 1 " | — | |
| Chromotrope 2R | — | 2 " | |
| Warm Water | 620 " | 620 " | |
| British Gum | 300 " | 300 " | |
| Oxalic acid | 20 " | 20 " | |
| Glycerine | 20 " | 20 " | |
| | 1000 parts | 1000 parts | |
| 14. Acid Violet N | 15 parts | | |
| Orange No. 2 | 24 " | | |
| Patent Blue V | 6 " | | |
| Ammonia | 40 " | | |
| Water | 315 " | | |
| British Gum 1:2 | 500 " | | |
| Oxalate of Ammonia | 30 " | | |
| Glycerine | 30 " | | |
| Turkey Red Oil 50% | 40 " | | |
| | 1000 parts | | |
| | | | Dark Brown for floral and conventional designs in hand-printing. |
| 15. Flavazine S | 5 parts | 16. Flavazine S | 12 parts |
| Victoria Rubine O | 14 " | Azo Acid | |
| Acid Violet N | 4 " | Magenta G | 1 " |
| Boiling Water | 657 " | Acid Violet N | 2 " |
| British Gum | 150 " | Water | 545 " |
| Glycerine | 50 " | Gum Sol. 1:2 | 350 " |
| Ammonia | 50 " | Acetic Acid Tannin | |
| Turkey Red Oil | 50 " | sol. 1:1 | 40 " |
| Oxalate of | | Glycerine | 50 " |
| Ammonia | 20 " | | 1000 parts |
| | 1000 parts | | |
| 17. Amido Naphtol | | 18. Dianil Fast | |
| Red 6B 1:50 | 60 parts | Brown R | 30 parts |
| Cyanine B 1:50 | 10 " | British Gum | 250 " |
| Flavazine S 1:50 | 120 " | Water | 680 " |
| Water | 180 " | Glycerine | 20 " |
| Senegal Gum 1:2 | 600 " | Phosphate of Soda | 20 " |
| Glycerine | 20 " | | 1000 parts |
| Oxalate of | | | |
| Ammonia | 10 " | | |
| | 1000 parts | | |
| 19. Oxydianil Yellow O | 7 parts | | |
| Dianil Crimson | 1 " | | |
| Dianil Green G | 2 " | | |
| Water | 310 " | | |
| British Gum 1:2 | 600 " | | |
| Glycerine | 20 " | | |
| Phosphate of Soda | 10 " | | |
| Water | 50 " | | |
| | 1000 parts | | |

D. Blue.

| | | | |
|------------------------|------------|-----------------------|------------|
| 20. Patent Blue V | 3 parts | 21. Patent Blue V | 30 parts |
| Water | 281 " | Acid Violet N | 10 " |
| Gum sol. 1:1 | 700 " | Water | 405 " |
| Glycerine | 10 " | Glycerine | 30 " |
| Oxalate of | | Tragacanth 60:1000 | 200 " |
| Ammonia | 3 " | warm until dissolved; | |
| Oxalic acid | 3 " | when cool add | |
| | 1000 parts | British Gum | 200 " |
| | | China Clay | 100 " |
| | | Oxalate of | |
| | | Ammonia | 25 " |
| | | | 1000 parts |
| 22. Naphtalene | | 23. Victoria Blue B | 20 parts |
| Blue DN | 30 parts | Acetic acid 6° Tw. | 60 " |
| Water | 670 " | British Gum 1:1 | 500 " |
| British Gum | 250 " | Water | 380 " |
| Oxalic acid | 10 " | Oxalic acid | 10 " |
| Glycerine | 20 " | Tartaric acid | 10 " |
| Oxalate of | | Glycerine | 20 " |
| Ammonia | 20 " | | 1000 parts |
| | 1000 parts | | |
| 24. Azo Acid Blue B | 40 parts | 25. Fast Blue RD | 40 parts |
| Water | 660 " | Water | 600 " |
| British Gum | 250 " | Ammonia | 50 " |
| Oxalic acid | 20 " | British Gum | 250 " |
| Tartaric acid | 10 " | Glycerine | 20 " |
| Glycerine | 20 " | Oxalate of | |
| | 1000 parts | Ammonia | 40 " |
| | | | 1000 parts |
| 26. Fast Blue 3R extra | 30 parts | 27. Marine Blue I. | |
| Water | 330 " | Milling Blue 2R | |
| Ammonia | 50 " | extra | 39 parts |
| British Gum | | Flavazine T | 1 " |
| sol 1:2 | 500 " | Water | 610 " |
| Glycerine | 20 " | British Gum | 230 " |
| Oxalate of | | Acetic acid 12° Tw. | 50 " |
| Ammonia | 30 " | Glycerine | 20 " |
| Turkey Red Oil | 40 " | Oxalic acid | 10 " |
| | 1000 parts | Acetic acid Tannin | |
| (for hand-printing). | | sol. 1:1 | 20 " |
| | | Fluoride of | |
| | | Chrome 1:1 | 20 " |
| | | | 1000 parts |

| | | | | | |
|-----|-----------------------------|------------|-----|--------------------------|------------|
| 28. | Marine Blue II. | | 29. | Lanoglaucline W | |
| | Chromotrope 6B | 8 parts | | paste | 150 parts |
| | Chromotrope 10B | 8 " | | Water | 175 " |
| | Patent Blue V | 16 " | | Tragacanth | |
| | Flavazine T | 1½ " | | 60 : 1000 | 375 " |
| | Water | 422 " | | British Gum | 250 " |
| | British Gum | 280 " | | Glycerin | 20 " |
| | China Clay 1:1 | 100 " | | boil, cool and add | |
| | Glycerine | 30 " | | Sodium Chlorate | |
| | Sulphate of | | | 1:3 | 30 " |
| | Alumina 1:1 | 100 " | | | 1000 parts |
| | Oxalate of | | | | |
| | Ammonia | 25 " | | | |
| | Oxalic acid | 10 " | | | |
| | | 1000 parts | | | |
| 30. | Alizarine Blue SB | | | | |
| | powder | 50 parts | | | |
| | Water | 350 " | | | |
| | British Gum Thickening | 500 " | | | |
| | Acetate of Chrome | | | for all Alizarine Blue S | |
| | 32" Tw. | 80 " | | brands. | |
| | Oxalic acid | 20 " | | | |
| | | 1000 parts | | | |
| 31. | Dianil Blue G | 30 parts | | | |
| | Water | 680 " | | | |
| | British Gum | 250 " | | for the Dianil Blue | |
| | Glycerine | 20 " | | brands. | |
| | Phosphate of Soda | 20 " | | | |
| | | 1000 parts | | | |
| 32. | | E. Violet. | | | |
| | Acid Violet 5BF | 20 parts | | | |
| | Water | 620 " | | | |
| | Ammonia | 10 " | | | |
| | British Gum | 250 " | | | |
| | Glycerine | 20 " | | | |
| | heat slightly, cool and add | | | for all Acid Violet and | |
| | Oxalate of Ammonia | 20 " | | Fast Acid Violet brands. | |
| | Water | 60 " | | | |
| | | 1000 parts | | | |
| | | F. Green. | | | |
| 33. | Naphtalene | | 34. | Chinoline | |
| | Green V | 30 parts | | Yellow O | 10 parts |
| | Water | 670 " | | Naphtalene | |
| | British Gum | 250 " | | Green V | 30 " |
| | Glycerine | 20 " | | Water | 660 " |
| | Oxalate of | | | British Gum | 250 " |
| | Ammonia | 20 " | | Glycerine | 30 " |
| | Oxalic acid | 10 " | | Oxalic acid | 10 " |
| | | 1000 parts | | Alum | 10 " |
| | | | | | 1000 parts |

| | | | |
|-----------|------------------------------------|------------|---|
| 35 | Flavazine T | 40 parts | |
| | Parent Blue V | 10 " | |
| | Water | 395 " | |
| | Glycerine | 30 " | |
| | Tragacanth 60:1000 | 200 " | |
| | British Gum powder | 200 " | |
| | China Clay 1:1 | 100 " | |
| | Oxalate of Ammonia | 25 " | |
| | | 1000 parts | |
| 36. | Flavazine S | 10 parts | |
| | Acid Violet N | 0.78 " | |
| | Cyanine | 1.38 " | |
| | Water | 480 " | |
| | Gum Solution 1:2 | 390 " | |
| | Glycerine | 50 " | |
| | Tannin 1:5 | 60 " | |
| | | 1000 parts | for hand-printing. |
| 37. | Ceruleine S conc. | 50 parts | |
| | Water | 350 " | |
| | British Gum Thickening | 500 " | |
| | Acetate of Chrome 32° Tw | 80 " | |
| | Oxalic acid crystals | 20 " | |
| | | 1000 parts | for all Ceruleine S brands. |
| 38. | Dianil Green G | 30 parts | |
| | Water | 680 " | |
| | British Gum | 250 " | |
| | Glycerine | 20 " | |
| | Phosphate of Soda | 20 " | |
| | | 1000 parts | for all Dianil Green brands. |
| G. Black. | | | |
| 39. | Carbon Black GAT | 60 parts | |
| | Water | 440 " | |
| | Glycerine | 30 " | |
| | Tragacanth 60:1000 | 100 " | |
| | Heat until dissolved and then add: | | |
| | British Gum powder | 250 " | |
| | China Clay paste 1:1 | 75 " | |
| | Acetic acid 50% | 15 " | |
| | Oxalic acid | 25 " | |
| | Sodium Chlorate | 5 " | |
| | | 1000 parts | This method is also applicable to all brands of Azo Acid Black. |

| | | | |
|-----|--------------------|-------------|--|
| 40. | Silk Wool Black D | 50 parts | |
| | Water | 565 | „ |
| | Ammonia | 30 | „ |
| | Glycerine | 20 | „ |
| | British Gum | 250 | „ |
| | heat up, and when | | |
| | cool add | | |
| | Oxalate of Ammonia | 50 | „ |
| | Sodium Chlorate | 5 | „ |
| | Water | 30 | „ |
| | | 1000 parts. | |
| 41. | Carbon Black GAT | 50 parts | |
| | Water | 645 | „ |
| | Ammonia | 50 | „ |
| | di-solve warm | | |
| | British Gum powder | 170 | „ |
| | heat up and when | | |
| | cool add | | |
| | Glycerine | 30 | „ |
| | Oxalate of Ammonia | 50 | „ |
| | Sodium Chlorate | 5 | „ |
| | | 1000 parts | |
| | | | for hand-printing, also for the Azo Acid Black brands and Silk Wool Black D. |

Half Wool Black for printing EBS gives also very good results on clean wool.

| | | |
|-----|-------------------|------------|
| 42. | Half Wool Black | |
| | for printing EBS | 60 parts |
| | Water | 630 |
| | British Gum | 250 |
| | Glycerine | 20 |
| | Phosphate of soda | 40 |
| | | 1000 parts |

H. Grey.

| | | | |
|-----|------------|----------------------|---------------------------|
| 43. | 200 parts | Nigrosine IV 1:50 | |
| | 20 | „ Ammonia | |
| | 600 | „ Senegal Gum 1:1 | |
| | 20 | „ Glycerine | |
| | 15 | „ Oxalate of Ammonia | |
| | 145 | „ Water | |
| | 1000 parts | | |
| | | | for all Nigrosine brands. |

| | | |
|-----|-------------|----------------------|
| 44 | parts | Amido Naphtol Red 2B |
| 4 | „ | Cyanine B |
| 1 | „ | Flavazine S |
| 301 | „ | Water |
| 20 | „ | Ammonia |
| 600 | „ | Senegal Gum sol. 1:1 |
| 20 | „ | Glycerine |
| 15 | „ | Oxalate of Ammonia |
| 85 | „ | Water |
| | 1000 parts. | |

II. DISCHARGE AND RESIST PRINTING.

Reducing agents are almost exclusively used for discharging woollen pieces; of oxidising agents only Nitric acid is employed to a very limited extent for discharging lists.

The most largely used discharges are the Tin, Zinc Dust and Hydrosulphite discharges; the latter especially have become important in recent times.

For Resist printing, the goods are printed with Tin Salts, Zinc Dust or Hydrosulphite pastes, and subsequently overprinted with thickened dyestuff solutions.

1. Tin Discharges.

For this purpose Tin Salts, Stannous Acetate and Stannous Oxide pastes are used. These discharges may be made acid, as the wool fibre is scarcely affected by a strong acid printing colour.

The following acids are used as additions to the Tin discharges: Tartaric, Citric and Oxalic acid, Acetone, Hydrochloric acid (rarely used), also Ammonium Sulphocyanide and Sodium Acetate; the latter is also employed for coloured discharges. Tin discharges leave on the cloth, at the discharged places, more or less insoluble tin compounds which sometimes cannot be completely removed; these compounds may turn the fibre yellow at the discharged places.

For this reason the Hydrosulphite discharge has largely replaced the Tin discharge; the latter is only used for coloured discharges such as blue on red, green on red, etc. The following colours are dischargeable with Tin:

a) Ground Colours for White Discharges.

| | |
|-------------------------|-------------------------------|
| Flavazine T, | Scarlet, especially the bluer |
| Flavazine, | brands, |
| Azo Yellow, | Amido Naphtol Red |
| Metanil Yellow extra, | Azo Acid Red B, |
| Orange No. 2, No. 4, G, | Victoria Violet, |
| | Azo Acid Blue B. |

b) Ground Colours for Coloured Discharges.

| | |
|-------------------------------|----------------------------------|
| Naphtol Yellow S, SE, | New Coccine O, |
| Azo Yellow, all brands, | Brilliant Croceine, all brands, |
| Flavazine T, | Fast Red O, S, |
| Flavazine, | Brilliant Crimson O, |
| Victoria Yellow, all brands, | Victoria Rubine O, |
| Metanil Yellow, all brands, | Amaranth O, |
| Chrysoine G, | Cloth Red O, |
| Orange, all brands, | Naphtol Red O, |
| Brilliant Orange, all brands, | Claret Red, all brands, |
| Scarlet, all brands, | Victoria Violet, all brands, |
| Victoria Scarlet, all brands, | Azo Acid Blue, all brands, |
| Scarlet 6R crystals, | Azo Acid Black, all brands, |
| | Chromotrope 2R, 2B, 6B, 8B, 10B. |

The following are applicable as Discharge colours in coloured Tin discharges:

Auramine,
Methylene Yellow H,
Flavophosphine,
Magenta,
Cerise,
Grenadine,
Maroon,
Safranine,
Phosphine,
Methyl Violet,
Methylene Violet,
Methylene Heliotrope,
Violet Crystals,
Brilliant Green,
Malachite Green,
Victoria Blue,
Methyl Alkaline Blue,
Alkaline Blue,
Opal Blue,
Full Blue,
Purple Blue,

Methylene Violet,
Blue de Lyon,
Conc. Cotton Blue,
Guernsey Blue,
Acid Violet,
Acid Green,
Patent Blue,
Cyanine,
Naphtalene Blue,
Naphtalene Green,
Fast Blue,
Induline,
Eosine,
Phloxine,
Rosazeine,
Fast Acid Eosine,
Fast Acid Phloxine,
Fast Acid Magenta,
Fast Acid Violet,
Fast Acid Blue,
Chinoline Yellow.

Examples of dischargeable shades:

Red:

2% Victoria Scarlet 3R
4% Sulphuric acid
168 $\frac{1}{2}$ ° Tw.
10% Glauber's salt.

Light Brown:

0,20% Azo Acid Blue B
0,75% Azo Yellow conc.
2,25% Orange I.

4% Sulphuric acid
168 $\frac{1}{4}$ ° Tw.
10% Glauber's salt.

Marine Blue:

1,75% Azo Acid Blue B
0,30% Amido Naphtol Red 2B
0,15% Flavazine T

4% Sulphuric acid
168 $\frac{1}{2}$ ° Tw.
10% Glauber's salt.

Grey:

0,25% Azo Acid Blue B
0,05% Amido Naphtol Red 2B
0,50% Flavazine T

4% Sulphuric acid
168 $\frac{1}{4}$ ° Tw.
10% Glauber's salt.

Claret Red:

4% Victoria Rubine O
0,75% Victoria Scarlet 3R
4% Azo Acid Blue B.

4% Sulphuric acid
168 $\frac{1}{2}$ ° Tw.
10% Glauber's salt.

Dark Brown:

2% Amido Naphtol Red 2B
1% Azo Acid Blue B
1% Flavazine T

4% Sulphuric acid
168 $\frac{1}{2}$ ° Tw.
10% Glauber's salt.

Olive:

1,10% Azo Yellow conc.
0,30% Azo Acid Blue B
4% Sulphuric acid 168° Tw.
10% Glauber's salt.

Black:

4% Azo Acid Black
4% Sulphuric acid
168 $\frac{1}{4}$ ° Tw.
10% Glauber's salt.

Recipes for White and Coloured Tin Discharges:
A. For Machine Printing.

| Discharge White: | | Discharge Blue: | |
|-------------------|---|-------------------|---|
| 500 parts | Acid Starch Thickening (Page 251) | 20 parts | Victoria Blue B |
| 100 „ | Acetic acid 30% | 140 „ | Boiling Water |
| 225 „ | Tin Salts Ia cryst. | 50 „ | Acetic acid 12° Tw. |
| 50 „ | Citric acid | 500 „ | Acid Starch Thickening |
| 75 „ | Sulphocyanide of Ammonia cryst. | 200 „ | Tin Salts Ia cryst. |
| 50 „ | Water | 20 „ | Citric acid |
| 1000 parts | | 70 „ | Acetate of Soda crystals. |
| Discharge Orange: | | Discharge Yellow: | |
| 30 parts | Flavophosphine R conc new | 1000 parts | |
| 120 „ | Boiling Water | 60 parts | Chinoline Yellow O |
| 50 „ | Acetic acid 12° Tw. | 150 „ | Boiling Water |
| 500 „ | Acid Starch Thickening | 500 „ | Acid Starch Thickening |
| 200 „ | Tin Salts Ia cryst. | 200 „ | Tin Salts Ia crystals |
| 20 „ | Citric acid | 20 „ | Citric acid crystals |
| 70 „ | Acetate of Soda crystals. | 70 „ | Acetate of Soda cryst. |
| 1000 parts | | 1000 parts | |
| Discharge Green: | | Discharge Red: | |
| 35 parts | Chinoline Yellow O | 20 parts | Chinoline Yellow O |
| 15 „ | Patent Blue V | 30 „ | Rosazeine extra |
| 160 „ | Boiling Water | 335 „ | Hot Water |
| 500 „ | Acid Starch Thickening (Page 251) | 50 „ | Solvay Soda 1:10 dissolve, thicken with |
| 200 „ | Tin Salts Ia cryst. | 250 „ | British Gum powder and add cold |
| 20 „ | Citric acid | 20 „ | Citric acid crystals |
| 70 „ | Acetate of Soda crystals. | 25 „ | Acetic acid 12° Tw. |
| 1000 parts | | 200 „ | Tin Salts Ia crystals |
| | | 70 „ | Acetate of Soda cryst. |
| | | 1000 parts | |
| Discharge Violet: | | | |
| 40 parts | Acid Violet N | | |
| 325 „ | Hot Water | | |
| 50 „ | Solvay Soda 1:10 dissolve, thicken with | | |
| 260 „ | British Gum powder and add cold | | |
| 20 „ | Citric acid crystals | | |
| 25 „ | Acetic acid 12° Tw. | | |
| 200 „ | Tin Salts Ia crystals | | |
| 70 „ | Acetate of Soda crystals | | |
| 1000 parts | | | |

Sulphocyanide of Ammonia may also be used in coloured discharges instead of Acetate of Soda.

B. For Hand Printing.

| | | | | | | | | | | |
|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------|
| Chinoline Yellow extra | 40 | — | — | — | — | — | — | — | — | pts. |
| Acid Violet N | — | 30 | — | — | — | — | — | — | — | " |
| Rosazene extra | — | — | 3 | — | — | — | — | — | — | " |
| Patent Blue A | — | — | — | 30 | — | — | — | — | — | " |
| Phloxine O | — | — | — | — | 50 | — | — | — | — | " |
| Naphtalene Green conc. | — | — | — | — | — | 30 | — | — | — | " |
| Auramine conc. | — | — | — | — | — | — | 20 | — | — | " |
| Victoria Blue B | — | — | — | — | — | — | — | 20 | — | " |
| Flavophosph R conc. new | — | — | — | — | — | — | — | — | 20 | " |
| Brilliant Green cryst. ex. | — | — | — | — | — | — | — | — | 20 | " |
| Water | 510 | 620 | 647 | 620 | 600 | 620 | 580 | 580 | 580 | " |
| British Gum powder | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | " |
| Acetic acid 50% | — | — | — | — | — | — | 50 | 50 | 50 | " |
| White | 300 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | " |
| | | | | | | | | | | 1000 pts. |

White:

| | | | |
|------------|------------------------------------|---|---|
| 250 parts | British Gum 1:2 | } | The quantity of Tin Salts varies according to the shade to be discharged. |
| 500 " | Tin Salts Ia cryst. | | |
| 200 " | Sulpho Cyanide of Ammonia crystals | | |
| 50 " | Citric acid crystals | | |
| 1000 parts | | | |

After printing and drying, the goods are steamed with moist steam for $\frac{1}{2}$ an hour, soured cold (10–20 parts conc. HCl. per 1000) and well washed.

2. Zinc Dust Discharges.

These pastes have been replaced in machine printing by the stable Hydrosulphite discharge-pastes, but they are still used in hand-printing on account of cheapness. Since Zinc Dust discharges impair the wool fibre when steamed under pressure, the latter operation must be carefully watched. The more Bisulphite present in the discharge, the more energetic is the action. Zinc Dust discharge pastes generally contain an excess of Zinc Dust which serves to convert the Bisulphite, produced by the decomposition of the Hydrosulphite formed, into Hydrosulphite again. An addition of Formaldehyde increases the stability of the Zinc Dust discharges. The Bisulphite may be replaced by Potassium Sulphide, which also improves the stability of the discharge paste.

Zinc Dust Discharges:

| I. | | II. | |
|------------|---|------------|---|
| 250 parts | Zinc Dust, mixed with water | 22 parts | for dark shades Dextrine |
| 200 " | Gum solution 1:1 grind well and add on cooling | 500 " | Bisulphite 66 $\frac{1}{2}$ ° Tw. dissolve, cool down and add slowly: |
| 400 " | Sodium Bisulphite 66 $\frac{1}{2}$ ° Tw. After the reaction ceases, | 350 " | Zinc Dust, mixed with water. After the reaction has ceased, |
| 30 " | Solvay Soda | 28 " | Solvay Soda |
| 70 " | Water | 100 " | Glycerine, are added |
| 50 " | Glycerine, are added | 1000 parts | |
| 1000 parts | | | |

| III. | | IV. | |
|------------|--|------------|---------------------------------|
| 250 parts | Zinc Dust, are mixed with water | 400 parts | Zinc Dust, are mixed with water |
| 230 .. | Gum solution 1:1, grind well and add on cooling: | 100 .. | Glycerine |
| 400 .. | Sodium Bisulphite | 20 .. | Water. |
| | 66 $\frac{1}{2}$ ° Tw. | | Stir into the cold mixture of |
| 70 .. | Formaldehyde 40% | 120 .. | British Gum powder |
| 50 .. | Glycerine | 360 .. | Potassium Sulphite |
| | | | 90° Tw. |
| 1000 parts | | 1000 parts | |

For the production of shades dischargeable with Zinc Dust, we refer to the list of dyestuffs mentioned on page 227.

For coloured discharges, the colours mentioned on page 228 which withstand the action of reducing agents, are employed.

3. Hydrosulphite Discharges.

The stable Formaldehyde compounds of Hydrosulphite: Hydrosulphite NF conc, NF and NFW, are used for this purpose.

Hydrosulphite NF conc. is Formaldehyde-Sodium Sulphoxalate in a highly concentrated form; Hydrosulphite NF is a molecular mixture of Formaldehyde-Sodium Sulphoxalate and Formaldehyde Bisulphite. Hydrosulphite NFW is a mixture of Hydrosulphite NF and Lithopone. These compounds are stable and can be easily printed. In the subsequent steaming operation some colours are split up into their component parts (Azo Colours), others are converted into leucocompounds which are destroyed by the superfluous Hydrosulphite. In many cases a small quantity of the reduced colour is retained very tenaciously by the wool fibre, which causes the discharged places to show up brown or coloured. This fault can be remedied by using white covering agents (Hydrosulphite NFW) and by selecting suitable colours.

Furthermore, thorough washing, and also souring after steaming, helps to cleanse the white and to make it stable.

The chlorination of the wool material before or after dyeing, exercises a favourable effect on the purity and stability of the discharged white and facilitates the fixation of the colours added to the coloured discharges.

Colouring matters are liable to exhaust rapidly, and therefore to dye unevenly, on chlorinated wool; however, by dyeing slowly in an Acetic acid bath and afterwards boiling the goods for a considerable time, even results can be obtained. The shades produced on chlorinated wool are less fast to washing than those produced on untreated material. The fastness to water and washing can be improved by rinsing with acidified water or by treating with Chrome salts.

Chroming is carried out by boiling the goods for $\frac{1}{4}$ — $\frac{1}{2}$ an hour in the exhausted dyebath, to which 4% Chromium Fluoride or 10% Chrome Alum has been added.

A deeply engraved roller is required for discharge styles on wool. Steaming must be carried out in the Mather-Platt, free from air, at about 212° F. for 3—5 minutes; moist steam is used.

The following wool dyestuffs are dischargeable to a stable white with Hydrosulphite:

| | |
|---|--|
| Flavazine T, | Fast Red O, |
| Flavazine S, | Victoria Rubine O, |
| Fast Yellow O, | Fast Claret Red O, |
| Milling Yellow O, | Acid Magenta B (about 2%), |
| Victoria Yellow conc. (about 1%), | Azo Acid Red B (about 2%), |
| Azo Yellow O (about 1%), | New Discharge Blue RH (about 3%), |
| Orange Nr. 2, | Wool Discharge Black GH. |
| Brilliant Orange G, R, | Opal Blue blue shade, |
| Scarlet 3R—6R, | Soluble Blue V, 2R, |
| Brilliant Croceine yellow shade and blue shade, | Blue Bluish, |
| Brilliant Crimson O, | Victoria Violet 8BS (about 1%), |
| Patent Blue A (about 1/2%), | Azo Acid Blue B conc., (about 1 1/2%), |
| Cyanine B (about 1%), | Discharge Black WT (about 4%), |
| Acid Green conc. (about 1 1/2%), | Acid Violet 5BF (about 1/2%), |
| Naphtalene Green conc. (about 1%), | Fast Acid Green BB, |
| Victoria Violet 4BS (about 1%), | Victoria Scarlet G, 6R. |
| New Coccine O, | |
| Amido Naphtol Red G, 2B, | |
| 6B, | |

Amongst others, the following easily dischargeable combinations are to be recommended:

A. for Ladies' Dress Goods.

Red: Scarlet 3R, or New Coccine O.
 Claret Red: Victoria Rubine or Victoria Scarlet, shaded with Cyanine B.
 Brown: Flavazine T, Azo Acid Red B and Cyanine B.
 Green: Azo Acid Blue B, Cyanine B and Flavazine T
 Navy Blue: New Discharge Blue RH.
 Black: Wool Discharge Black GH.

B. for Gentlemen's suitings, besides the above named combinations.

Navy Blue: Chromotrope Blue A developed with Bichrome.
 Brown: Acid Alizarine Grey, Acid Alizarine Grenade R and Mordant Yellow O, developed with Bichrome.
 Black: Chromotrope Discharge Black FW developed with Bichrome.

C. for Carpets and Wool Plush.

Red: Victoria Scarlet 3R or Acid Magenta G.
 Copper Red: Brilliant Orange, Azo Acid Red B and Cyanine B.
 Claret Red: Azo Acid Red, Victoria Rubine O and Cyanine B.
 Navy Blue: Cyanine B, Azo Acid Blue B and Flavazine T.
 Light Blue: Cyanine B and Azo Acid Blue B.
 Green, Stone Green & Olive: with Flavazine T, Azo Acid Red B, Azo Acid Blue B and Cyanine B.

D. for Mohair Plush

if the back has also to be dyed at the same time, the following Dianil colours are suitable:

Yellow: Aurophenine O and Dianil Fast Brown B.
 Claret Red: Dianil Pink BD, Dianil Red 10B and Dianil Violet H.
 Brown: Aurophenine O, Dianil Fast Brown B and Dianil Black ES.
 Green: Cresotine Yellow G and Dianil Green G.
 Black: Patent Dianil Black FF conc. and Half Wool Black for Printing EBS.

If the cotton ground in mohair plush has been dyed with Sulphur Black, the wool is dyed with the dyestuffs given on page 227.

For the production of coloured discharges, dyestuffs which withstand the action of Hydrosulphite are used; they are fixed by means of Albumen or Tannic acid.

If the ground material of the mohair plush has been previously dyed with Sulphur colours, the above mentioned Acid colours are used instead of the Dianil colours.

The following dyestuffs are suitable for coloured discharges:

| | |
|---------------------|------------------------------|
| Chinoline Yellow, | Erythrosine, |
| Methylene Yellow H, | Discharge Red NF, |
| Auramine, | New Discharge Red G, B, 2B, |
| Flavophosphine, | Methylene Blue, |
| Phosphine, | Thionine Blue GO, |
| Rosazeine, | Discharge Navy Blue N extra, |
| Eosine, | Fast Blue 2R, |
| Phloxine, | Lanocyanine W paste. |

The following recipes for white and coloured discharges are very efficacious:

A. White Discharges.

| | |
|-----------------------------|----------------------------|
| Discharge White NFW: | Discharge White NFC: |
| 600 parts Hydrosulphite NFW | 150 parts Hydrosulphite NF |
| 300 „ Starch Thickening | conc. |
| 100:1000; heat until | 425 „ Starch Thickening |
| dissolved, cool down | 100:1000; heat until |
| and add cold the | dissolved, cool down |
| following mixture: | and add cold the |
| 90 „ Albumen 1:1 | mixture of |
| 10 „ Ammonia | 250 „ Zinc White |
| 1000 parts. | 75 „ Water |
| | 90 „ Albumen 1:1 |
| | 10 „ Ammonia |
| | 1000 parts. |

Starch Thickening 100:1000.

| | |
|------------------------|----------------|
| 160 parts Wheat Starch | } Boil for |
| 900 „ Water | |
| 1000 parts. | 10—15 minutes. |

Instead of Starch Thickening, Gum solution or other thickenings may be used.

B. Coloured Discharges.

I. For Dress materials.

The dyestuff is dissolved in warm water containing Glycerine; British Gum and China Clay are then added and the mixture warmed up again; finally, after cooling, Tannic acid solution, Alcohol and Hydrosulphite NF (previously dissolved in Gum solution) are slowly added. Additions of Zinc Oxide or Tin Hydroxide along with Ethyl Tartaric acid or Acetine are advantageous, especially when the goods have to be steamed rather longer than usual.

After printing, the goods are steamed with moist steam for 5 minutes in the Mather-Platt at 214° F. and then washed.

The colours mentioned in the following recipes may also be printed with 1 part of Albumen solution per 10 parts of printing colour, instead of with Tannic acid.

| | Yellow | Orange | Red | Blue | Green | |
|-----------------------------|--------|--------|-----|------|-------|--------|
| Chinoline Yellow O | 50 | — | 10 | — | 30 | parts. |
| Flavophosphine R conc. new. | — | 40 | — | — | — | „ |
| Discharge Red NF | — | — | 40 | — | — | „ |
| Thionine Blue GO | — | — | — | 10 | 10 | „ |
| Water | 305 | 275 | 265 | 305 | 345 | „ |
| Glycerine | 40 | 40 | 40 | 40 | 40 | „ |
| British Gum powder | 180 | 180 | 180 | 200 | 180 | „ |
| China Clay paste 1:1 | 150 | 150 | 150 | 200 | 150 | „ |
| Aqueous Tannin solution 1:1 | — | 40 | 40 | 20 | 20 | „ |
| Alcohol | 50 | 50 | 50 | — | — | „ |
| Hydrosulphite NF conc. | 150 | 150 | 150 | 150 | 150 | „ |
| Gum solution 1:1 | 75 | 75 | 75 | 75 | 75 | „ |

2. For Wool Muslin, Wool Plush etc.

The following coloured discharges are printed either by hand or machine, then dried and fixed by steaming (with moist steam) for 1 hour in the ordinary steam box. After steaming they are washed and dried.

Method:

| | | |
|-------------|-------|---|
| 20—50 | parts | Colour*) |
| 120—50 | „ | Water |
| 40 | „ | Glycerine |
| 120 | „ | British Gum Thickening 1:1 (Page 252) |
| 200 | „ | China Clay paste 1:1 |
| 70 | „ | Zinc Oxide paste 1:1 |
| 50 | „ | Acetine (or Ethyl Tartaric acid 21½° Tw) heat until dissolved, then cool and add |
| 40 | „ | Castor Oil |
| 50 | „ | Spirit |
| 140—175 | „ | Hydrosulphite NF conc. dissolved in |
| 180—155 | „ | Gum solution 1:1 |
| 1000 parts. | | |

*) When using Lanocyanine W paste, 120—180 parts of Colour are required. Thionine Blue, Discharge Navy Blue and Lanocyanine W paste require only about 140 parts Hydrosulphite NF conc.

In wool plush printing where fastness to rubbing is of importance, the following colours are chiefly used:

New Discharge Red G, B, 2B.

Chinoline Yellow O, — Lanocyanine W paste.

The following colours may be used for bright discharges, but are less fast to rubbing:

| | |
|------------------------------|-------------------------------|
| Auramine conc., | Rosazeine G, B, O, 6GD extra, |
| Flavophosphine 4G conc. new, | Eosine & Phloxine, |
| 2G conc. new, G conc. new, | Discharge Navy Blue N extra, |
| R conc. new, | Thionine Blue GO, |
| Leather Yellow O, | New Methylene Blue N, |
| | Discharge Red NF. |

For Black printing colour along with Hydrosulphite discharge, see next page.

3. For Carpets.

| | Yellow | Red | Blue | Light Blue | Grey |
|------------------------|--------|------|------|---------------|------------|
| Chinoline Yellow O | 50 | — | — | — | — |
| New Discharge G or B | — | 50 | — | — | — |
| Lanocyanine W paste | — | — | 120 | — | — |
| Thionine Blue GO | — | — | — | 10 | — |
| Fast Blue 2R | — | — | — | — | 10 |
| Glycerine | 50 | 50 | 50 | 50 | 50 |
| Water | 155 | 150 | 80 | 190 | 190 |
| China Clay 1:1 | 200 | 250 | 250 | 250 | 250 |
| British Gum | 120 | 150 | 150 | 150 | 150 |
| Alcohol | 50 | 50 | 50 | 50 | 50 |
| Hydrosulphite NF conc. | 250 | 200 | 200 | 200 | 200 |
| Gum Solution 1:1 | 125 | 100 | 100 | 100 | 100 |
| | 1000 | 1000 | 1000 | 1000 | 1000 parts |

By combining the above printing colours, mixed shades are obtained, e. g.

| | | | |
|------------------|--|------------------|--|
| Orange: | | Tobacco: | |
| 900 parts Yellow | | 820 parts Yellow | |
| 100 „ Red | | 140 „ Red | |
| | | 40 „ Blue | |
| Green: | | Brown: | |
| 700 parts Yellow | | 300 parts Yellow | |
| 300 „ Blue | | 500 „ Red | |
| | | 200 „ Blue | |

For White and Black the following recipes may be used:

| | | | |
|--------------------------|--|-----------------------------|--|
| White: | | Black: | |
| 250 parts China Clay 1:1 | | 50 parts Azo Acid Black 3BL | |
| 150 „ British Gum | | extra | |
| 200 „ Water | | 560 „ Water | |
| 50 „ Glycerine | | 250 „ British Gum | |
| 50 „ Alcohol | | 50 „ Glycerine | |
| 200 „ Hydrosulphite NF | | 20 „ Oxalic acid | |
| conc. | | 40 „ Alum | |
| 100 „ Gum solution 1:1 | | 30 „ Sodium Chlorate | |
| 1000 parts | | 1000 parts | |

After printing, the goods are steamed with saturated steam for 1 hour, allowed to lie for some time, washed in cold water and dried.

B. WOOL YARN PRINTING.

Wool yarns are printed in order to produce fancy effects in the manufacture of carpets, hosiery etc.; the method of working resembles very closely that used for piece goods.

Worsted, carpet, knitting and zephyr yarns are used for this purpose; according to their condition, the yarns must be cleansed, bleached and chlorinated before printing.

The bleaching is carried out by means of Sulphurous acid, Hydrogen Peroxide or Sodium Peroxide. The yarn is first placed in water at a temperature of 125° F., allowed to steep over-night and then washed with 3% Soda and 4% Soap at 115° F. While still moist, the material is placed in the sulphur stove for 5–6 hours, then rinsed and chlorinated in the following manner:

100 parts of yarn are treated in a bath containing 10–12 times the amount of water, to which 6 parts of Sulphuric acid 168° Tw. are added. The yarn is worked for $\frac{1}{4}$ of an hour and then gradually — within $\frac{3}{4}$ of an hour — 12 parts Hypochlorite of Soda solution 1.5° Tw. are added. The bath is kept cold throughout. The yarn is then soured off with 6 parts Sulphuric acid 168° Tw., washed until all the acid has been removed from the material and finally dried at 115–125° F.

Instead of the sulphur bleach the following method, which simultaneously increases the affinity of the wool fibre for the colouring matter, is often used: The yarn is cleansed with Soda, washed, hydroextracted and placed for 12 hours in a bath containing 6% Sodium Peroxide (powder) and 3.8% of Sulphuric acid 168° Tw. (referring to the weight of the yarn).

When sufficiently bleached the goods are washed, hydroextracted and dried. The affinity of the yarn for the printing colour is increased by adding Glycerine to the last rinsing bath.

Woollen yarns are printed either in warp or hank form. For this purpose the so-called colour printing machine or mangle (more seldom the iron printing machine) is employed. In carpet yarn printing the warp yarns are beamed on large drums and the separate colours printed one after another. Lately a particularly constructed printing machine (Hoffmann's) has been used with success for this purpose. Long-reel carpet yarns are generally printed by hand.

The following thickenings are used: Carrageen Moss, Tragacanth paste, Gum Arabic, British Gum or Leigomme; on account of its reducing properties Dextrine is less often used. It is most advisable to use Tragacanth paste, to which may be added British Gum or small quantities of Gum Arabic.

In carpet yarn printing pure Starch thickenings or cheaper thickenings produced from seaweed and mosses such as Carrageen etc. are used. Basic colours are precipitated out by the latter.

After printing, the yarn, which need not necessarily be dried, is steamed for 1-2 hours with moist steam and then rinsed. If Mordant colours have been used, an addition of Soap is made to the rinsing bath.

The composition and preparation of the printing colours generally is the same as described previously under wool piece printing. However, in yarn printing, the colour pastes must be made somewhat thinner; as a rule 200 parts of Tragacanth Water 60:1000 or 300 parts of British Gum 1:1 to 1000 parts of printing colour are sufficient.

C. SLUBBING PRINTING.

(Vigoureux Printing.)

The slubbing is first cleansed in Soap, then passed through a gill box to obtain a uniform sliver, and finally printed by passing it between embossed rollers with cross-stripes. The printed colours are fixed by steaming, the slubbing then washed in the back-wash and soaped.

The depth of the printed colour depends very considerably on the quality of the wool; coarser qualities yield fuller shades than do finer qualities.

The preparation and application of the printing colours and also the process of steaming, remains almost exactly the same as for wool pieces. However, the chlorinating and preparatory processes are, in most cases dispensed with, since they impair the fibre. Fluoride of Chrome is generally used for fixing Mordant colours; before adding it to the printing colour it is mixed into a paste with one quarter of its weight of pure water in a wooden vessel. In order not to diminish the spinning properties of the wool the quantity of the mordants, especially Chrome Mordants, must be kept as low as possible. A small addition of Tournant Olive oil or Castor oil improves not only the printing propensity of the colour, but also exercises a favourable influence on the handle of the wool. Dyestuffs which are sensitive to copper e.g. the Vigoureux colours, require the addition of a small quantity of Sulphocyanide of Ammonia. On account of the difficult fixation of Mordant colours on unchlorinated material, it is often necessary to prolong the steaming process. It is advisable to steam the printed goods (without previous drying) for 1 hour without pressure, then allow the material to cool for 1 hour and then steam again for 1 hour.

The steamed goods are allowed to lie over-night, which improves the depth of the shade; finally they are back-washed and finished (gilled) in the usual manner.

The recipes given for piece goods are also employed for slubbing, but the quantity and selection of the thickening agent is somewhat different. British Gum, in the proportion of 250 parts per 1000 parts of printing colour, is most frequently used.

The following colours, printed with Chrome Mordants, are used for gentlemen's suitings:

| | |
|-----------------------------|---------------------------|
| Vigoureux Yellow I, | Ceruleine „S“ brands, |
| Vigoureux Black I, | Alizarine Direct Blue B, |
| Vigoureux Brown I, | Alizarine Direct Green G, |
| Vigoureux Grey I, | Fast Mordant Blue B, R. |
| Vigoureux Black I, RU, | Acid Alizarine Blue, |
| Alizarine Yellow GG, 5G, | Acid Alizarine Green, |
| Alizarine Orange, | Acid Alizarine Black, |
| Alizarine Red IWS, 3WS, PS, | Acid Alizarine Brown, |
| Alizarine Claret R, | Acid Alizarine Grenade, |
| Alizarine Brown, | Acid Alizarine Red. |
| Lanocyanine W paste, | Acid Alizarine Yellow, |
| Alizarine Blue „S“ brands, | Dianil Fast Red PH. |
| Alizarine Green „S“ brands, | |

For ladies' dress goods etc. Acid colours are also used. The selection of the dyestuffs depends on the degree of fastness required. For the fastness properties of the wool dyestuffs, see the chapter on wool dyeing.

The printing colours are prepared as follows:

| Mordant Colours: | | Acid Colours: | |
|------------------|-------------------------------|---------------|---------------------|
| 50 parts | Colour | 20 parts | Colour |
| 522 „ | Hot Water | 580 „ | Water |
| 250 „ | British Gum | 300 „ | British Gum powder |
| 50 „ | Acetic acid 12° Tw. | 30 „ | Glycerine |
| | Add cold | 50 „ | Acetic acid 50% |
| 40 „ | Dilute Sulphuric acid. | 20 „ | Oxalic acid (solid) |
| | (500 parts 158° Tw. per 1000) | 1000 parts | |
| 50 „ | Fluoride of Chrome | | |
| 12,5 „ | Water | | |
| 5 „ | Sodium Chlorate | | |
| 20 „ | Tournant oil | | |
| 0,5 „ | Sulphocyanide of Ammonia | | |
| 1000 parts | | | |

DYESTUFFS WHICH WITHSTAND 2 HOURS' STEAMING AT 2 ATM. PRESSURE.

| | |
|---------------------------|---------------------------|
| Flavazine L, S, | Cyanine B, |
| Flavazine T, | Indigo Substitute BS, WE, |
| Orange G, No. 2, 2R, | Azo Acid Blue B, |
| Brilliant Orange O, R, G, | Naphtalene Blue DN, |
| Scarlet G, R, RR, 3R, 5R, | Patent Green VS, V, O, |
| Milling Scarlet 4RO, | Naphtalene Green V, |
| Naphtol Red O, | Indigo, |
| Fast Red O, S, | Discharge Black WT, |

| | |
|---------------------------------|-----------------------------------|
| Claret Red R, G, B, | Fast Blue, all brands, |
| Amido Naphtol Red G, | Nigrosine No. I, |
| Fast Acid Violet, all brands, | Phosphine extra, |
| Fast Acid Red A, | Safranine O, |
| Fast Acid Blue R, | Acid Alizarine Red G, B, |
| Fast Acid Eosine G, | Acid Alizarine Grenade R, |
| Fast Acid Phloxine A, | Acid Alizarine Violet N, |
| Acid Rosamine A, | Acid Alizarine Green G, |
| Rosazine O, B, | Acid Alizarine Brown B, BB, T, |
| Fast Acid Magenta G, | Copper Black SB, S, |
| Eosine extra yellow, extra sol. | Chromotrope Blue A, |
| in water, | Acid Alizarine Blue WE, |
| Erythrosine, blue shade, | Chromotrope S, FB, F4B, |
| Phloxine O, B, | Acid Alizarine Blue BB, GR, |
| Rose Bengale B, | Acid Alizarine Dark Blue SN, |
| Acid Violet 5BF, N, | Acid Alizarine Black, all brands. |
| Victoria Blue B, R, 4R, | Alizarine Blue, all brands. |
| Neutral Blue R, | |
| Neutral Violet O, | |
| Patent Blue, all brands, | |

TABLE SHOWING THE DEGREE OF DISCHARGEABILITY OF COLOURS ON WOOL AND SILK.

1. Colours discharged to a pure white, even in dark shades.
2. Colours discharged white in light shades.
3. Colours not discharged white, but suitable for light coloured discharges.
4. Colours not discharged white, suitable only for dark coloured discharges.
5. Colours not discharged at all, and therefore suitable as additions to coloured discharge pastes.

| Colour | Tin Discharge | Zinc Discharge | Hydro-sulphite Discharge |
|---|---------------|----------------|--------------------------|
| Methylene Yellow H | 4 | 4 | 4 |
| Auramine O | 5 | 3 | 4 |
| Flavophosphine 4G conc. G conc., R conc. | 5 | 5 | 5 |
| Auroflavine KR | 5 | 5 | 4-5 |
| Phosphine O, extra | 4 | 4 | 5 |
| Azophosphine GO, BRO | 2-3 | 2 | 2 |
| Leather Yellow O | 5 | 5 | 5 |
| Rosazeine B extra B, O | 4-5 | 4-5 | 4-5 |
| Rosazeine G extra | 4-5 | 4 | 5 |
| Rosazeine 4G | 4-5 | 4-5 | 4-5 |
| Rosazeine 6G | 5 | 5 | 5 |
| Discharge Red NF | 4-5 | 4-5 | 5 |
| Safranine AN extra. O | 5 | 5 | 4 |
| New Magenta O | 4-5 | 2 | 2 |
| Magenta small crystals | 4-5 | 2 | 2 |
| Grenadine R | 4-5 | 2-3 | 2 |
| Cerise G | 4-5 | 4-5 | 2 |
| Methylene Violet 3RA extra, BN pdr. Methylene Heliotrope O | 5 | 4-5 | 4 |
| Methyl Violet 5R, B, BB, 8B superior Violet crystals O | 5 | 4 | 4 |
| Marine Blue DRX, DRI, DBI | 5 | 2-3 | 2-3 |
| Victoria Blue 4R, B | 5 | 2-3 | 3 |
| Methylene Blue D2R, DBB conc. | 4-5 | 3 | 3 |
| New Methylene Blue N | 5 | 2-3 | 2 |
| Thionine Blue GO | 4-5 | 3-4 | 3-4 |
| Discharge Navy Blue S extra conc. Methylene Grey N, O | 5 | 4 | 4 |
| Brilliant Green crystals extra | 5 | 4 | 4 |
| Methylene Green extra yellow D, DG, Malachite Green crystals extra | 5 | 3 | 2-3 |
| Eosine extra | 4-5 | 4 | 3-4 |
| Erythrosine blue shade | 5 | 3 | 2-3 |
| Phloxine O | 4-5 | 4 | 4-5 |
| Rose Bengale O | 4-5 | 4 | 4-5 |
| Fast Acid Eosine G | 5 | 3-4 | 4-5 |

| Colour | Tin Dis-charge | Zinc Dis-charge | Hydro-sulphite Dis-charge |
|--|----------------|-----------------|---------------------------|
| Fast Acid Phloxine A | 5 | 3-4 | 4-5 |
| Fast Acid Red A | 4 | 3 | 4-5 |
| Fast Acid Magenta G | 5 | 3-4 | 3 |
| Fast Acid Violet A2R, B | 5 | 3-4 | 3 |
| Fast Acid Blue R conc. | 5 | 4 | 3-4 |
| Fast Acid Green BB extra | 5 | 2 | 2 |
| Acid Rosamine A | 5 | 4-5 | 4 |
| Acid Magenta B | 4-5 | 2 | 1 |
| Acid Violet 5BF | 4-5 | 2 | 1-2 |
| Milling Blue 2R extra | 5 | 3-4 | 3 |
| Neutral Blue R | 4-5 | 2 | 1-2 |
| Neutral Violet O | 4-5 | 2-3 | 2 |
| Alkaline Blue 2B | 4-5 | 2 | 1-2 |
| Alkaline Violet O | 4-5 | 3 | 2 |
| Methyl Alkaline Blue MLB | 4-5 | 2 | 1-2 |
| Guernsey Blue O | 5 | 2 | 1-2 |
| Soluble Blue SV | 5 | 2 | 1-2 |
| Blue de Lyon O | 5 | 2 | 1-2 |
| Opal Blue blue shade | 5 | 2 | 1-2 |
| Full Blue O | 5 | 2 | 1-2 |
| Opal Blue superior, soluble in water | 5 | 2 | 1-2 |
| Blue Bluish | 5 | 2 | 1-2 |
| Purple Blue O | 5 | 2 | 1-2 |
| Blue red shade | 5 | 2 | 1-2 |
| Pure Blue | 5 | 2 | 1-2 |
| Conc. Cotton Blue R | 5 | 2 | 1-2 |
| Cotton Light Blue | 5 | 2 | 1-2 |
| Methyl Blue for Cotton MLB | 5 | 2 | 1-2 |
| Chinoline Green | 5 | 4 | 4 |
| Acid Green conc. | 4-5 | 2 | 1-2 |
| Naphtalene Green V | 4-5 | 2 | 1-2 |
| Patent Blue V | 4-5 | 2 | 2 |
| Patent Green V | 4-5 | 2 | 2 |
| Cyanine B | 4-5 | 2 | 1-2 |
| Naphtalene Blue B | 4-5 | 2 | 2 |
| Indigo Substitute BS | 5 | 2 | 2 |
| Patent Marine Blue LE | 4 | 3 | 3 |
| Fast Blue R | 4-5 | 5 | 5 |
| Fast Blue green shade | 5 | 5 | 5 |
| Fast Dark Blue R | 4-5 | 4-5 | 4-5 |
| Nigrosine | 4-5 | 4-5 | 4-5 |
| Chinoline Yellow O | 5 | 5 | 5 |
| Naphtol Yellow S | 4 | 4 | 4 |
| Flavazine T | 1-2 | 1-2 | 1 |
| Flavazine S | 1-2 | 1-2 | 1-2 |
| Azo Yellow conc. | 1-2 | 2-3 | 2-1 |

| Colour | Tin Dis-charge | Zinc Dis-charge | Hydro-sulphite Dis-charge |
|---|----------------|-----------------|---------------------------|
| Fast Yellow O | 1 | 2-1 | 2-1 |
| Victoria Yellow conc. | 2-3 | 1-2 | 1-2 |
| Milling Yellow O | 1-2 | 1-2 | 1-2 |
| Chrysoine G | 1-2 | 3 | 2-3 |
| Orange No. 2 | 1-2 | 1 | 1 |
| Orange No. 4 | 1-2 | 2-1 | 1-2 |
| Orange G, R, RR | 1-2 | 2-1 | 1 |
| Brilliant Orange G, R | 1-2 | 1 | 1 |
| Fast Brown O | 2 | 2-3 | 2 |
| Azo Brown V | 2-3 | 2-3 | 2 |
| Scarlet G, R, RR-6R | 1 | 1-2 | 1 |
| New Discharge Red G, B | 4-5 | 4-5 | 5 |
| Scarlet B extra | 2-3 | 1-2 | 1-2 |
| Scarlet 6R crystals | 2-3 | 1-2 | 2 |
| Milling Scarlet 4RO | 4 | 1-2 | 1-2 |
| New Coccine O | 2-3 | 1-2 | 1 |
| Victoria Scarlet G, GG, 3G | 2-3 | 1-2 | 1 |
| Brilliant Croceine yellow shade, 3B | 1-2 | 2 | 1 |
| Brilliant Croceine blue shade | 1-2 | 2 | 1 |
| Naphtol Red O | 1-2 | 1 | 1 |
| Fast Red O | 2 | 1-2 | 1 |
| Fast Red S | 1 | 1-2 | 1 |
| Brilliant Crimson O | 2 | 1-2 | 1 |
| Victoria Rubine O | 2 | 1 | 1 |
| Amaranth O | 2 | 1 | 1-2 |
| Cloth Red O | 2 | 1-2 | 1-2 |
| Fast Claret Red O | 1 | 2 | 1 |
| Claret Red B | 2-1 | 1 | 1-2 |
| Claret Red G | 2-3 | 1-2 | 1-2 |
| Claret Red R | 2 | 2 | 1-2 |
| Alkaline Fast Red | 2 | 2-3 | 1-2 |
| Amido Naphtol Red G | 1 | 2-3 | 1 |
| Amido Naphtol Red 2B, 6B | 1 | 1 | 1 |
| Azo Acid Magenta G | 4 | 2 | 1 |
| Azo Acid Carmine B | 3 | 2 | 2 |
| Azo Acid Red B | 1 | 2 | 1 |
| Azo Acid Brown RO | 4 | 1-2 | 1-2 |
| Victoria Violet 4BS | 1 | 2 | 2 |
| Victoria Violet 8BS | 2 | 2 | 2 |
| Azo Acid Blue B | 2 | 2 | 2 |
| Azo Acid Blue 3B conc. | 2 | 2 | 2-3 |
| Azo Acid Black 3BL extra, TL ex. | 3 | 3-4 | 3 |
| Amido Naphtol Black 4B, 6B | 3 | 3-4 | 2-3 |
| Chromotrope 2R | 1 | 1-2 | 2-3 |
| Chromotrope 6B | 3 | 2-3 | 2-3 |
| Chromotrope 8B | 3 | 3 | 3 |

| Colour | Tin Dis-charge | Zinc Dis-charge | Hydro-sulphite Dis-charge |
|--|----------------|-----------------|---------------------------|
| Wool Printing Black NB | 3 | 2-3 | 2-3 |
| Discharge Black for Wool GH | 3 | 1-2 | 1-2 |
| Silk Wool Black G | 3 | 2 | 1-2 |
| Discharge Black WF | 4 | 3 | 2 |
| Carbon Black BD | 3 | 3 | 3 |
| Alphyl Blue Black O | 3-4 | 3-4 | 3-4 |
| Wool Scarlet 2R | 1-2 | 1-2 | 1-2 |
| Chromotrope Blue A | 5 | 2-3 | 2 |
| Chromotrope Discharge Black FW | 4 | 2-3 | 2 |
| Mordant Yellow O | 4 | 2-3 | 2-3 |
| Alizarine Yellow GG paste | 3 | 2-3 | 5 |
| Alizarine Yellow 5G powder | 4-5 | 2-3 | 2-3 |
| Alizarine Yellow GGW powder | 3 | 3-4 | 3 |
| Alizarine Yellow R paste (Chrome mordant) | 3 | 3 | 2-3 |
| Alizarine Yellow RW pdr. (Chrome mordant) | 2 | 3 | 2-3 |
| Alizarine Yellow KR (Chrome mordant) | 3-4 | 3-4 | 3 |
| Acid Alizarine Yellow RC (Chrome mordant) | 4-5 | 3-4 | 3 |
| Alizarine Orange (Alumina mordant) | 4 | 4 | 4 |
| Alizarine Orange (Chrome mordant) | 5 | 5 | 5 |
| Alizarine Red IWS (Alumina mordant and Chrome mordant) | 4-5 | 5 | 4 |
| Alizarine Red 4FW (Alumina mordant) | 5 | 5 | 5 |
| Alizarine Red 4FW (Chrome mordant) | 4-5 | 4-5 | 4 |
| Alizarine Claret R (Alumina mordant) | 5 | 5 | 4-5 |
| Alizarine Claret R (Chrome mordant) | 5 | 5 | 5 |
| Galleine A paste | 5 | 5 | 5 |
| Alizarine Brown paste | 5 | 5 | 5 |
| Alizarine Blue SBW | 5 | 5 | 5 |
| Alizarine Blue F | 5 | 5 | 5 |
| Alizarine Dark Blue S | 5 | 5 | 5 |
| Alizarine Direct Blue B | 4-5 | 4 | 4 |
| Alizarine Direct Blue EB | 4-5 | 4 | 4 |
| Alizarine Direct Blue E3B | 4-5 | 4 | 4 |
| Alizarine Direct Violet R | 4-5 | 4 | 4 |
| Alizarine Direct Green G | 4-5 | 4 | 4 |
| Alizarine Green S | 5 | 5 | 5 |
| Ceruleine SW | 5 | 5 | 5 |
| Acid Alizarine Red G | 5 | 4-5 | 4 |
| Acid Alizarine Red B | 5 | 3 | 3 |
| Acid Alizarine Grenade R | 5 | 3 | 3 |
| Acid Alizarine Violet N | 5 | 3 | 3 |
| Acid Alizarine Blue WE | 5 | 3-4 | 3 |
| Acid Alizarine Dark Blue SN | 5 | 5 | 5 |

| Colour | Tin Dis-charge | Zinc Dis-charge | Hydro-sulphite Dis-charge |
|--|----------------|-----------------|---------------------------|
| Acid Alizarine Blue Black B | 4-5 | 3 | 3 |
| Acid Alizarine Grey G | 4 | 4 | 4 |
| Acid Alizarine Brown B, BB | 4-5 | 4-5 | 4 |
| Acid Alizarine Black R | 5 | 4 | 4 |
| Acid Alizarine Green G | 5 | 5 | 5 |
| Chrome Brown RO | 4-5 | 4 | 4 |
| Chrome Black B | 4-5 | 4-5 | 4 |
| Indigo MLB | 5 | 5 | 5 |
| Dianil Pure Yellow HS | 4-5 | 4-5 | 3 |
| Dianil Yellow 3G | 5 | 3 | 3 |
| Dianil Direct Yellow S | 5 | 3 | 3 |
| Cresotine Yellow G | 5 | 1-2 | 1 |
| Aurophenine O | 5 | 1-2 | 1-2 |
| Oxydianil Yellow O | 5 | 4 | 4 |
| Oxydianil Yellow G | 5 | 4 | 3 |
| Dianil Orange N | 5 | 3 | 3 |
| Toluylene Orange R | 5 | 4 | 4 |
| Dianil Brown 3GO, R, BD | 4-5 | 1 | 1 |
| Dianil Brown MH | 2 | 2 | 1 |
| Dianil Fast Brown B | 3 | 2 | 1 |
| Delta Purpurine 5B | 4 | 4 | 2 |
| Brilliant Dianil Red R | 4 | 4 | 2 |
| Dianil Fast Scarlet RS | 2-3 | 2-3 | 1 |
| Dianil Fast Scarlet GS | 2-3 | 2-3 | 1 |
| Dianil Fast Scarlet 4BS | 2-3 | 2-3 | 1 |
| Dianil Fast Scarlet 6BS | 3 | 2 | 1 |
| Dianil Fast Scarlet 8BS | 3 | 2 | 1 |
| Dianil Fast Red PH | 1-2 | 1-2 | 1 |
| Dianil Red 4B | 3-4 | 1-2 | 1 |
| Dianil Red 10 B | 3-4 | 1 | 1 |
| Dianil Pink BD | 4 | 2-3 | 1-2 |
| Dianil Claret Red R | 3 | 3 | 2-3 |
| Dianil Claret Red B | 3-4 | 1 | 1 |
| Dianil Violet H | 4 | 2 | 1 |
| Dianil Blue G, B, R | 3-4 | 1 | 1 |
| Dianil Blue H6G | 3 | 1-2 | 1 |
| Dianil Azurine G | 3 | 1-2 | 1 |
| Dianil Indigo O | 3 | 1-2 | 1 |
| Dianil Dark Blue R | 3-4 | 1-2 | 1 |
| Dianil Green G, B | 3-4 | 1-2 | 1 |
| Dianil Dark Green B | 3-4 | 1-2 | 1 |
| Dianil Black CR | 2-3 | 2 | 1-2 |
| Half Wool Black for printing EBS | 2-3 | 2 | 1-2 |
| Patent Dianil Black FF conc. | 2-3 | 2 | 1-2 |
| Dianil Black ES | 2-3 | 2 | 1-2 |

SILK PRINTING.

The silk fibre resembles wool to such an extent as regards its affinity to most dyestuffs, that the printing of silk varies little from the printing of wool.

The Basic, Acid, Dianil and also some Mordant colours can be fixed on silk without the use of mordants. Aniline Black, Diphenyl Black, Nitroso Blue and Solid Green can be produced on silk as well as on cotton. These colours are applied in printing according to the recipes given in the chapter on Half Silk Printing.

On account of their unsatisfactory fastness to rubbing the insoluble Azo colours are not suitable for silk printing.

Direct, Discharge and Resist styles are employed in silk printing.

I. Direct Print.

The silk material is first boiled off with about 30% Olive oil Soap, washed, and soured with about 4% Hydrochloric acid or with Acetic acid. If it is necessary to first bleach the goods, this is effected by stoving, or by treating them in a weak alkaline bath with Hydrogen Peroxide.

By previously preparing the goods with Tin the silk is rendered much more suitable for printing with Dianil colours.

The wet material is padded with Chloride of Tin 7.5° Tw. and allowed to remain rolled up for 1—2 hours. It is then passed through a bath containing 50 parts Sodium Phosphate per 1000 parts of liquid and after lying again for 1—2 hours, is well washed and dried.

Where greater fastness to water and washing is required, mordants must be employed.

The most suitable thickening agents are: the best kinds of Gum Senegal, Gum Arabic, Gum Industreille, Dextrine and British Gum. Starch thickenings are not very suitable, since it is a difficult matter to wash them out of the goods after steaming. Gum thickenings should not be employed for Chrome mordants, as hard places are formed where the goods are printed. Glycerine assists the equalising properties of the printing colour; an addition of Ammonia tends to keep the colours in solution (especially Acid colours).

After printing the goods are dried, steamed with moist steam for 1—1½ hours, and in the case of Basic colours having been employed, passed through Tartar Emetic, washed, soured and dried.

1.

Basic Colours with Tannin, specially suitable for:

| | |
|-----------------------------|----------------------------------|
| Auramine, all brands, | Victoria Blue, |
| Flavophosphine, all brands, | Induline for Printing (dissolved |
| Methylene Yellow H, | in Acetine), |
| Leather Yellow, | Acetinduline, |
| Leather Yellow Base, | Brilliant Green, |
| Phosphine, | Malachite Green, |
| Azophosphine, | Rosazeine 4G, 6G and 6 GD, |
| Magenta, | Safranine, |
| Methyl Violet, | Methylene Violet, |
| Thionine Blue, | Methylene Heliotrope, |
| Ethyl Blue, | Methylene Grey, |
| New Ethyl Blue, | Silk Grey, |
| Fast Cotton Blue, | Nigrosine. |

| | |
|-------------|----------------------------------|
| 20 parts | Colour, |
| 100 „ | Acetic acid 50%, |
| 600 „ | Senegal Gum thickening 1:1, |
| 10-20 „ | Tartaric acid, |
| 40 „ | Acetic Acid Tannin solution 1:1, |
| 220 „ | Water. |
| <hr/> | |
| 1000 parts. | |

2.

Basic colours without Tannin:

| | |
|---------------------------|----------------------------------|
| Azophosphine, | Induline for Printing (dissolved |
| Phosphine, | in Acetine), |
| Flavophosphine, | Acetinduline solution, |
| Vesuvine, | Methylene Green "D" brands, |
| Methylene Heliotrope, | Methylene Grey, |
| Rosazeine 6G, 4G and 6GD, | Fast Cotton Blue, |
| Methylene Violet, | Nigrosine, |
| Leather Yellow Base, | Silk Grey. |

| | |
|-------------|----------------------------|
| 20 parts | Colour, |
| 600 „ | Water, |
| 100 „ | Acetic acid 50%, |
| 230 „ | Gomme Industrielle powder, |
| 20 „ | Tartaric acid, |
| 30 „ | Glycerine. |
| <hr/> | |
| 1000 parts. | |

3.

The following Dianil Colours:

| | |
|--------------------------|---------------------|
| Primuline, | Aurophenine O, |
| Dianil Yellow 3G, R, 2R, | Oxydianil Yellow O, |
| Dianil Direct Yellow S, | Dianil Orange G, N, |
| Cresotine Yellow G, | Toluylene Orange R, |

| | |
|-------------------------------|------------------------------|
| Delta Purpurine 5B, | Dianil Dark Blue R, 3R, |
| Brilliant Dianil Red R, | Dianil Green 2G, G, |
| Dianil Red 4B, 6B, 10B, R, | Dianil Dark Green B, |
| Dianil Magenta O, | Dianil Japonine G, |
| Dianil Claret Red B, G, | Dianil Brown 5G, 3GO, 2G, G, |
| Dianil Crimson B, G, | Dianil Brown X, 3R, R, M, |
| Dianil Blue B, R, 2R, 3R, 4R. | BD, RD, |
| BX, E, ET, | Dianil Fast Brown B, |
| Dianil Indigo O. | Dianil Black N, G, T. |

| | |
|-------------|----------------------------|
| 30 parts | Colour, |
| 670 .. | Water, |
| 240 .. | Gomme Industrielle powder, |
| 30 .. | Phosphate of Soda, |
| 30 .. | Glycerine. |
| <hr/> | |
| 1000 parts. | |

4.

The following Acid Colours:

| | |
|---------------------------|-----------------------|
| Flavazine, | Victoria Rubine, |
| Chinoline Yellow, | Brilliant Crimson, |
| Milling Yellow, | Acid Magenta, |
| Fast Yellow, | Acid Cerise, |
| Fast Brown, | Acid Green, |
| Azo Brown, | Naphtalene Green, |
| Orange, | Naphtalene Blue, |
| Brilliant Orange, | Silk Blue, |
| Scarlet, | Methyl Blue for Silk, |
| Scarlet crystals, | Eosine, |
| Scarlet for Silk, | Phloxine, |
| Diamond Scarlet for Silk, | Erythrosine, |
| Fast Red, | Rosazeine, |
| Amaranth, | Fast Acid Eosine, |
| | Fast Acid Phloxine. |

| | |
|--------------|-------------------|
| 20— 40 parts | Colour, |
| 330—310 .. | Water, |
| 630 .. | Senegal Gum, 1·1. |
| 30 .. | Glycerine, |
| 20 .. | Tartaric acid. |
| <hr/> | |
| 1000 parts | |

5.

The following Acid Colours:

| | |
|-----------------------|-------------------|
| Alkali Blue, | Patent Blue, |
| Alkali Violet, | Cyanine, |
| Methyl Alkaline Blue, | Naphtalene Green, |
| Opal Blue, | Violamine, |
| Blue de Lyon, | Fast Acid Violet, |
| Fast Dark Blue. | Nigrosine, |
| Acid Violet, | Fast Blue, |
| | Induline. |

| | | |
|-------|--------|-------------------------|
| 30 | parts | Colour, |
| 170 | „ | Water, |
| 50 | „ | Ammonia, |
| 700 | „ | Gomme Industrielle 1:2, |
| 30 | „ | Glycerine, |
| 20 | „ | Tartaric acid. |
| <hr/> | | |
| 1000 | parts. | |

6.

Janus Colours:

| | |
|---------------|-----------------------|
| Janus Yellow, | Janus Dark Blue, |
| Janus Brown, | Janus Green, |
| Janus Blue, | Janus Black. |
| 40 | parts Colour, |
| 50 | „ Acetic acid 50%, |
| 50 | „ Lactic acid 50%, |
| 565 | „ Water, |
| 250 | „ British Gum powder, |
| 30 | „ Glycerine, |
| 10 | „ Tartaric acid, |
| 5 | „ Sodium Chlorate. |
| <hr/> | |
| 1000 | parts. |

7.

Alizarine Red and Orange
with Alumina:

| | | |
|-------|--------|--|
| 237 | parts | Wheat Starch Tragacanth thickening (page 251), |
| 50 | „ | Para Soap PN, |
| 50 | „ | Acetic acid 50%, |
| 5 | „ | Tartaric acid, |
| 190 | „ | Colour-paste 20%, |
| 190 | „ | Sulphocyanide of Alumina 18 1/2° Tw., |
| 48 | „ | Acetate of Alumina 18 1/2° Tw., |
| 95 | „ | Acetate of Lime 28° Tw., |
| 95 | „ | Oxalate of Tin 9° Tw. |
| <hr/> | | |
| 1000 | parts. | |

8.

Alizarine Pink with
Alumina:

| | | |
|-----|-------|---------------------------------------|
| 500 | parts | Senegal Gum 1:1, |
| 20 | „ | Para Soap PN, |
| 50 | „ | Acetic acid 50%, |
| 4 | „ | Tartaric acid, |
| 20 | „ | Colour paste 20%, |
| 20 | „ | Sulphocyanide of Alumina 18 1/2° Tw., |
| 5 | „ | Acetate of Alumina 18 1/2° Tw., |
| 10 | „ | Acetate of Lime 28 1/2° Tw., |
| 10 | „ | Oxalate of Tin 9° Tw. |

Make up to 1000 parts with water.

9.

The Alizarine IWS, PS
brands.
(Alizarine Sulphonic
acids.)

| | | |
|-------|--------|--------------------------|
| 40 | parts | Colour (powder), |
| 630 | „ | Water, |
| 250 | „ | British Gum powder, |
| 65 | „ | Sulphate of Alumina 1:1, |
| 20 | „ | Tartaric acid. |
| <hr/> | | |
| 1000 | parts. | |

10.

Alizarine Colours in paste, with Chrome Mordants:

| | |
|------------------------------|--------------------------------|
| Alizarine Red paste brands, | Alizarine Green S paste, |
| Alizarine Yellow GG, GGW, R, | Alizarine Brown paste, |
| RW, | Ceruleine S paste brands, |
| Alizarine Orange paste, | Alizarine Blue S paste brands. |
| Alizarine Claret R paste, | |

| | |
|-------------|---|
| 150 parts | Colour paste 20 ⁰ / ₀ , |
| 150 | „ Water, |
| 500 | „ British Gum 1:1, |
| 30 | „ Glycerine, |
| 20 | „ Tartaric acid, |
| 150 | „ Acetate of Chrome 32 ¹ / ₂ ⁰ Tw. |
| <hr/> | |
| 1000 parts. | |

11.

Alizarine Colours in powder, with Chrome Mordants:

| | | |
|----------------------|---|--------------------------|
| Alizarine Yellow 5G, | GGW, | Alizarine Red SW-brands, |
| RW, | | Alizarine Blue S-brands, |
| Mordant Yellow O, N, | | Alizarine Brown brands. |
| 30—50 | parts Colour, | |
| 550—500 | „ Water, | |
| 250 | „ British Gum powder. | |
| 30 | „ Glycerine, | |
| 20 | „ Tartaric acid, | |
| 120—150 | „ Acetate of Chrome 32 ¹ / ₂ ⁰ Tw. | |
| <hr/> | | |
| 1000 parts. | | |

For light Alizarine shades, with the exception of the “S” brands, it is advisable to make the printing paste slightly alkaline with Ammonia (12); Borax is also used to bring about the solution of Mordant colours in combination with neutral Chrome Mordants (13, 14).

12.

Light Alizarine shades with Chrome:

| | | |
|-------------|----------|--|
| { | 10 parts | Colour paste (when using powder brands correspondingly less colour is used), |
| | 50 | „ Water, |
| | 20 | „ Ammonia, |
| | | are stirred into the following thickening: |
| { | 540 | „ Yellow Dextrine, |
| | 322 | „ Water, |
| | 50 | „ Acetic acid 50 ⁰ / ₀ and |
| | 8 | „ Acetate of Chrome 32 ¹ / ₂ ⁰ Tw. |
| | | added cold. |
| <hr/> | | |
| 1000 parts. | | |

13 and 14.

Alizarine Colours with neutral Chrome Mordant:

Alizarine Red WS-brands,
 Acid Alizarine Grenade,
 Acid Alizarine Yellow,
 Acid Alizarine Red,
 Acid Alizarine Blue,
 Acid Alizarine Brown,
 Acid Alizarine Grey.

| | | | |
|-----------|--|-------------|---------------------------|
| 150 parts | Colour paste (when using powder brands correspondingly less colour is required), | 30—50 parts | Colour, |
| | | 490—440 | „ Water, |
| | | 50 | „ Ammonia, |
| | | 250 | „ British Gum powder, |
| 380 | „ Water, | | |
| 250 | „ British Gum 1:1, | 30 | „ Glycerine, |
| 30 | „ Glycerine, | 30 | „ Tartaric acid, |
| 20 | „ Borax, | 120—150 | „ Neutral Chrome Mordant. |
| 170 | „ Neutral Chrome Mordant. | | |
| | | 1000 parts. | |

1000 parts.

Neutral Chrome Mordant:

1. { 1165 parts Acetate of Chrome 32 $\frac{1}{2}$ ° Tw.,
200 „ Glycerine,
2. { 8 „ Soda,
72 „ Water are dissolved and stirred into solution I.

15.

Dischargeable Printing Black:

| | |
|-----------|-----------------------|
| 100 parts | Discharge Black NF, |
| 590 | „ Water, |
| 250 | „ British Gum powder, |
| 30 | „ Glycerine, |
| 30 | „ Tartaric acid. |

1000 parts.

16.

Silk Wool Black:

| | |
|-----------|-----------------------|
| 100 parts | Silk Wool Black D, |
| 540 | „ Water, |
| 50 | „ Ammonia, |
| 240 | „ British Gum powder, |
| 30 | „ Glycerine, |
| 40 | „ Tartaric acid. |

1000 parts.

The wool and silk are dyed about the same depth.

17.

Acid Alizarine Black:

| | |
|----------|--|
| 80 parts | Acid Alizarine Black 3B extra, |
| 305 | „ Water, |
| 30 | „ Glycerine, |
| 240 | „ British Gum powder, |
| 50 | „ Acetic acid 50%, |
| 40 | „ Oxalic acid, |
| 15 | „ Sodium Chlorate solution 1:3, |
| 278 | „ Acetate of Chrome 32 $\frac{1}{2}$ ° Tw. |

also for other Acid Alizarine Black brands; Naphtalene Green conc. is suitable for shading.

18.

Aniline Black:

| | | |
|-------|--------|--|
| 75 | parts | Aniline Oil, |
| 105 | „ | Nitric acid 57° Tw., |
| 40 | „ | Acetic acid 50°/o, |
| | | are stirred into the mixture of |
| 500 | „ | Wheat Starch Tragacanth thickening (page 251), |
| 50 | „ | Olive oil, |
| 40 | „ | Sodium Chlorate and |
| 75 | „ | Yellow Prussiate of Potash, |
| 105 | „ | Water added. |
| <hr/> | | |
| 1000 | parts. | |

develop by steaming in the Mather-Platt.

19.

Diphenyl Black:

| | | | | |
|-------|---|------|--------|--|
| 1. | { | 60 | parts | Diphenyl Black Oil DO and, |
| | | 150 | „ | Acetic acid 30°/o, |
| | | | | are stirred into |
| 2. | { | 480 | „ | Wheat Starch Tragacanth thickening (page 251), |
| | | 150 | „ | Water, |
| | | 33 | „ | Hydrochloric acid 36° Tw., |
| | | 13 | „ | Chloride of Alumina 52 1/2° Tw., |
| 3. | { | 20 | „ | Chloride of Chrome 52 1/2° Tw., |
| | | 4 | „ | Copper Chloride 78 1/2° Tw., |
| | | 30 | „ | Sodium Chlorate, |
| | | 60 | „ | Water. |
| <hr/> | | | | |
| | | 1000 | parts. | |

Before use, solutions 2 and 3 are stirred into I. The shade is developed by steaming in the Mather-Platt, but may also be developed by steaming in a closed steam box.

II. DISCHARGE PRINTS.

For this purpose the Tin salts, Zinc dust and Hydrosulphite discharges are employed.

1. Tin Salt Discharges.

This process is used principally for coloured discharges because the white obtained by this method is not stable, but turns yellow in storing. Strong Tin discharges injure the fibre.

The following colours are dischargeable with Tin Salts:

a) Ground colours for white discharges.

Victoria Yellow, Metanil Yellow, Orange No. 4, No. 2, G, Scarlets, (especially the bluer brands), also those Dianil colours which are easily discharged on cotton.

b) Ground colours for coloured discharges.

| | |
|-------------------------|--------------------|
| Naphtol Yellow, | Amaranth, |
| Azo Yellow, | Fast Red, |
| Victoria Yellow, | Brilliant Crimson, |
| Metanil Yellow, | Victoria Rubine, |
| Orange No. 4, G, No. 2, | Naphtol Red, |
| Brilliant Orange, | Cloth Red, |
| Scarlet, | Claret Red, |
| Victoria Scarlet, | Chromotrope, |
| Scarlet crystals. | Azo Acid Blue, |
| New Coccine, | Victoria Violet. |
| Brilliant Croceine, | Azo Acid Black, |

also those Dianil colours which are easily discharged with Tin Salts.

The following are applicable for coloured discharges with Tin Salts:

| | |
|-----------------------|-------------------|
| Auramine, | Full Blue, |
| Magenta, | Purple Blue, |
| Cerise, | Blue de Lyon, |
| Grenadine, | Cotton Blue. |
| Maroon, | Guernsey Blue, |
| Phosphine, | Acid Violet, |
| Rosazeine, | Patent Blue, |
| Methyl Violet, | Cyanine, |
| Brilliant Green, | Naphtalene Blue, |
| Malachite Green, | Naphtalene Green, |
| Methyl Alkaline Blue, | Victoria Blue, |
| Alkaline Blue, | Chinoline Yellow. |
| Opal Blue, | |

White Discharge:

| | |
|-----------|-----------------------|
| 450 parts | Acid Starch, |
| 120 „ | Tragacanth (80:1000), |
| 125 „ | Tin Salts Ia cryst., |
| 230 „ | Water, |
| 50 „ | Sulphocyanide of |
| | Ammonia. |
| 29 „ | Citric acid 36° Tw. |

Blue Discharge I:

| | |
|-------------|----------------------|
| 30 parts | Acid Violet N, |
| 10 „ | Patent Blue V, |
| 110 „ | Water, |
| 700 „ | Gum Solution 1:1 |
| 100 „ | Tin Salts Ia cryst., |
| 30 „ | Sulphocyanide of |
| | Ammonia, |
| 20 „ | Citric acid. |
| 1000 parts. | |

Yellow Discharge:

| | |
|-------------|----------------------|
| 30 parts | Auramine conc , |
| 140 „ | Water. |
| 700 „ | Gum Solution 1:1, |
| 90 „ | Tin Salts Ia cryst , |
| 25 „ | Sulphocyanide of |
| | Ammonia, |
| 15 „ | Citric acid., |
| 1000 parts. | |

Blue Discharge II:

| | |
|----------|----------------------|
| 30 parts | Methyl Violet 2B, |
| 10 „ | Malachite Green |
| | cryst. extra, |
| 113 „ | Acetic acid 6° Tw , |
| 700 „ | Gum Solution 1:1, |
| 100 „ | Tin Salts Ia cryst., |
| 30 „ | Sulphocyanide of |
| | Ammonia, |
| 20 „ | Citric acid, |

| Red Discharge: | | Green Discharge: | |
|----------------|-----------------------------|------------------|---------------------------------|
| 30 | parts Rosazeine extra, | 15 | parts Auramine O. |
| 5 | „ Auramine conc., | 15 | „ Brilliant Green cryst. extra, |
| 135 | „ Water, | 72 | „ Acetic acid 6° Tw., |
| 700 | „ Gum solution 1:1, | 750 | „ Gum solution 1:1, |
| 90 | „ Tin Salts Ia crystals, | 100 | „ Tin Salts Ia crystals, |
| 25 | „ Sulphocyanide of Ammonia, | 30 | „ Sulphocyanide of Ammonia, |
| 15 | „ Citric acid. | 20 | „ Citric acid. |
| 1000 parts. | | 1000 parts. | |

2. Zinc Dust Discharges.

This method of discharging is used only in hand printing, having been replaced by the Hydrosulphite discharge in machine printing. The preparation of the Zinc-dust discharges is described in the chapter on wool printing.

The following colours are dischargeable with Zinc dust:

a) Ground colours for white discharges.

| | |
|-----------------------------------|-------------------|
| Victoria Yellow, | Blue de Lyon, |
| Orange No. 4, No. 2, G, | Full Blue, |
| Brilliant Orange, | Purple Blue, |
| Scarlet (bluish brands), | Guernsey Blue, |
| New Coccine, | Silk Blue, |
| Victoria Scarlet (bluish brands), | Blue bluish, |
| Fast Red, | Blue red shade, |
| Claret Red, | Acid Magenta, |
| Brilliant Crimson, | Acid Green, |
| Amaranth, | Naphtalene Blue, |
| Victoria Rubine, | Naphtalene Green, |
| Naphtol Red, | Patent Blue, |
| Methyl Alkaline Blue, | Cyanine, |
| Alkaline Blue, | Flavazine. |
| Light Blue, | |

b) Ground colours for coloured discharges:

The colours mentioned under (a) as well as the following

| | |
|-----------------------------------|-------------------------|
| Naphtol Yellow, | Chromotrope, |
| Azo Yellow, | Azo Acid Blue, |
| Scarlet G, | Victoria Violet, |
| Scarlet Crystals, | Azo Acid Black B, R, G. |
| Scarlet B extra, | Alkali Violet, |
| Victoria Scarlet (yellow brands), | Acid Cerise. |

The following are suitable for coloured discharges with Zinc dust:

| | |
|-----------------------|-----------------------------|
| Chinoline Yellow, | Auramine conc., |
| Safranin, | Discharge Red NF, |
| Methylene Violet, | Fast Blue 2R, |
| Methylene Blue, | Flavophosphine 2G conc., R, |
| Lanoglaurine W paste, | conc., |
| Phosphine O, | Rosazeine G extra, |
| Thionine Blue GO, | New Discharge Red B, G. |

3. Hydrosulphite Discharges.

The discharge pastes are prepared with Hydrosulphite NF or NF conc. along with Gum or Wheat Starch-Tragacanth thickening and China Clay.

The printed goods are steamed for 3—5 minutes in the Mather-Platt, as free as possible from air, at 212—216° F. The steaming may also be carried out for 1 hour in the steam chest. After steaming the goods are washed and finished. The dyestuffs suitable for Zinc Dust discharges are also suitable for Hydrosulphite discharges, the following being recipes for the same:

| Discharge White: | | Thickening WT: | |
|------------------|--------------------|----------------|-----------------------|
| 65—150 parts | Hydro.NF conc., | 75 parts | Wheat Starch, |
| 335—250 | „ Water, | 325 | „ Water, |
| 400 | „ Thickening WT, | 600 | „ Tragacanth 60:1000. |
| 200 | „ China Clay paste | 1000 parts, | |
| | 1:1. | | |
| 1000 parts. | | | |

Coloured Discharges:

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10. |
|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Chinoline Yellow O | 30 | — | — | — | — | — | — | 20 | — | — |
| Lanoglucine W paste | — | 125 | — | — | — | — | — | 40 | — | — |
| Phosphine O | — | — | 30 | — | — | — | — | — | — | 1 |
| Thionine Blue GO | — | — | — | 6 | — | — | — | — | — | — |
| Auramine conc. | — | — | — | 24 | — | — | — | — | — | — |
| Discharge Red NF | — | — | — | — | 40 | — | — | — | — | — |
| Fast Blue 2R | — | — | — | — | — | 10 | — | — | — | 29 |
| Flavophosphine 2G conc. | — | — | — | — | — | — | 30 | — | — | — |
| Rosazeine G extra | — | — | — | — | — | — | — | — | 25 | — |
| Flavophosphine R conc. | — | — | — | — | — | — | — | — | 15 | — |
| Glycerine | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Water | 170 | 75 | 170 | 170 | 160 | 190 | 170 | 140 | 160 | 170 |
| Gum solution 1:1 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Alcohol | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| Hydrosulphite NF conc. | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| Gum solution 1:2 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| make up to 1000 parts. | | | | | | | | | | |

III. Resists Prints.

Resists printing is employed in all cases where the dyestuffs to be used are not perfectly dischargeable. By printing two certain resists a series of steam colours can also be resisted.

The following substances are used in resist printing: Resins, Fats, also Stannous Salts, Antimony Compounds and Zinc Dust. These substances act partly mechanically, and partly in a chemical manner. Indigo may also be resisted on silk by means of pulps such as are often employed in calico printing; Aniline Black and Nitroso Blue are resisted as described in the chapter on half silk

printing. After printing with resists which act only in a mechanical manner, e. g. Fats and Resins, the goods are dried, then dyed in a cold bath, washed and dried. The fat or resin is finally removed by passing the goods through a Benzine bath.

Multi-coloured effects are produced by printing and dyeing several times. All colours which dye silk in a cold bath may be used for dyeing.

The Zinc dust resists, which act partly mechanically and partly chemically, are over-printed with such colours as are destroyed by Zinc dust in printing. Therefore all colours which are easily dischargeable with alkali are suitable.

Zinc Dust Resist.

| | |
|-------------|---------------------|
| 540 parts | Gum solution 1:1, |
| 350 „ | Zinc Dust made into |
| | a paste with water, |
| 100 „ | China Clay. |
| <hr/> | |
| 1000 parts. | |

Resin Resist.

| | |
|-------------|-------------|
| 650 parts | Colophonum, |
| 50 „ | Yellow Wax, |
| 300 „ | Benzine. |
| <hr/> | |
| 1000 parts. | |

CALICO PRINTING.

The THICKENINGS used in calico printing are produced according to the following recipes:

1. Acid Starch Thickening.

| | |
|--------------|--------------------|
| 2100 parts | Wheat Starch, |
| 5700 „ | Water, |
| 2200 „ | Acetic Acid 9° Tw. |
| <hr/> | |
| 10000 parts. | |

are boiled, then cooled.

Especially suitable for very dark shades printed with Basic dyestuffs.

2. Thickening St. T.

| | |
|--------------|----------------------|
| 1200 parts | Wheat Starch, |
| 6000 „ | Water, |
| 1800 „ | Tragacanth(60:1000). |
| 1000 „ | Acetic acid 9° Tw. |
| <hr/> | |
| 10000 parts. | |

are boiled, then cooled

Suitable for medium shades and for blotches which do not give sufficiently even results with Acid Starch.

3. Wheat Starch Tragacanth Thickening.

| | |
|--------------|----------------------|
| 700 parts | Wheat Starch, |
| 3000 „ | Water, |
| 6300 „ | Tragacanth(60:1000), |
| <hr/> | |
| 10000 parts. | |

are boiled, then cooled.

A good thickening for medium and light shades, to be recommended for Ice colours etc.

4. Thickening for Red.

| | |
|--------------|-----------------------|
| 1000 parts | Wheat Starch, |
| 200 „ | Wheat Flour, |
| 7200 „ | Water, |
| 350 „ | Tourant oil and |
| 650 „ | Acetic acid 9° Tw. |
| <hr/> | |
| 300 „ | Tourant oil and |
| 300 „ | Turpentine are added, |
| <hr/> | |
| 10000 parts. | |

Especially suitable for Alizarine colours which require oil.

5 Flour Tragacanth Thickening.

| | |
|--------------|----------------------|
| 2100 parts | Wheat Flour, |
| 4300 „ | Water, |
| 3000 „ | Tragacanth(60:1000), |
| 600 „ | Acetic acid 9° Tw. |
| <hr/> | |
| 10000 parts. | |

are boiled, then cooled.

The best thickenings for Ice colours, both as regards the beauty of the shades and the stability of the printing colours.

6. Tragacanth (60:1000).

| | |
|--------------|-------------|
| 600 parts | Tragacanth, |
| 9400 „ | Water, |
| <hr/> | |
| 10000 parts. | |

are allowed to stand for 24 hours; then boiled for 8 hours under pressure.

Is used by itself with Ice colours, and in mixtures with Starch thickenings.

7. Flour Thickening.
 1000 parts Wheat Flour,
 9000 „ Water.
 10000 parts.
 are boiled, then cooled.
 Suitable for Hydrosulphite
 discharges.

8. Thickening SG.
 (700 parts China Clay,
 1000 „ Water,
 1400 „ Wheat Starch,
 1950 „ Water,
 3700 „ Gum Solution 1:1,
 150 „ Wax,
 1100 „ Tournant oil.
 10000 parts.
 are boiled, then cooled.
 Recommended as thickening
 for printing resists.

9. British Gum
 Thickening.
 5000 parts British Gum pdr.
 5000 „ Water.
 10000 parts.
 are boiled, then cooled.
 For resists and discharges.

10. Thickening BRW.
 1000 parts Wheat Starch,
 2000 „ British Gum,
 7000 „ Water.
 10000 parts.
 are boiled, then cooled.
 Suitable for Chrome colours
 which coagulate readily with
 Tragacanth thickenings; also for
 Thiogene colour discharge prints.

11. Alkaline Thickening B.
 1000 parts British Gum powder,
 9000 „ Soda lye 76° Tw.
 10000 parts
 are boiled for ¼ hour.

12. Alkaline Thickening
 WB.
 700 parts British Gum powder,
 350 „ Wheat Starch,
 2000 „ Water,
 100 „ Caustic Soda 76° Tw.
 Allow to stand over-
 night and add,
 7000 „ Caustic Soda 76° Tw.
 heat up to 140° F.
 and then cool.
 10150 parts,
 For printing Indigo, Sulphur
 colours, and Tannin discharge
 styles.

13. Thickening TN.
 1500 parts Wheat Starch,
 3100 „ Water,
 3000 „ Acetic acid 9° Tw.
 770 „ Tournant oil,
 1630 „ Tragacanth(60:1000).
 10000 parts.
 The water, wheat starch and
 acetic acid are boiled together
 for ½ an hour; then cooled
 down until luke-warm, when the
 remaining ingredients are added.
 For Chrome colours.

14. Gum Solution 1:1.
 5000 parts Senegal Gum,
 5000 „ Water.
 10000 parts.
 are allowed to stand and dissol-
 ved at the boil.
 For light, clean prints, as it
 gives even results.

15. Albumen 1:1.
 5000 parts Egg Albumen (or
 blood Albumen),
 5000 „ Water.
 10000 parts
 are left to stand till completely
 dissolved.
 Is used for fixing Pigment
 colours.

I. BASIC COLOURS.

These colours form Tannin lakes which are insoluble or only slightly soluble; the fastness of these lakes is considerably increased by Antimony Salts.

The Basic colours come into the market as salts, in which the base is coupled with Hydrochloric acid or less frequently with Acetic acid, Sulphuric acid or Oxalic acid. In many cases the Basic colours form double salts with Chloride of Zinc. But as Chloride of Zinc is apt to tender the cotton fibre in steaming, the employment of simple Hydrochlorides, which are free from Zinc, or of the colour bases themselves, is preferable. The latter are dissolved by means of organic acids.

For Basic colours which are insoluble in water, Ethyl Tartaric acid and Acetine are used as solvents.

A. Direct or Steam Printing with Basic Colours.

The printing pastes contain dyestuff, thickening, the quantity of Tannin required for fixing, and substances acting as solvents and preventing the premature formation of lakes, which would render the printing pastes useless. Such substances are Acetic, Formic, Lactic, Tartaric, Ethyl Tartaric acid, Acetine, Carbolic acid and Glycerine. Since fixed acids are liable to injure the cotton during steaming, tartaric acid has been replaced by Ethyl Tartaric acid which dissociates on steaming, and whose action is consequently much slower. Acetine acts similarly and moreover is also a solvent for dyestuffs insoluble in water. Glycerine and Acetine, which forms Glycerine on steaming, also act as hygroscopic substances.

By the action of steam, lakes are formed and the dyestuff is fixed in the fibre. After steaming, the prints are passed through a bath containing 5—10 parts Tartar Emetic per 1000 parts liquor, at 86—120° F. for $\frac{1}{2}$ minute; some Soda or Chalk is also added to the bath. The goods may also be padded with a concentrated solution of Tartar Emetic, allowed to lie for some time and then thoroughly washed.

Other Antimony Compounds may be used instead of Tartar Emetic, e. g. Antimony Salts, double Antimony Fluoride, Antimonine etc.

Antimonine must be applied with the addition of Acetic acid, but the other Antimony Compounds require alkaline additions such as Soda, Chalk etc.

For the complete removal of thickenings containing starch, the goods are sometimes malted. This operation is mostly carried out in rope form for $\frac{1}{4}$ — $\frac{1}{2}$ an hour at 86—122° F. with 20—50 parts of Malt per 1000 parts of liquor, or about 5% of Diastaphor (referring to the weights of the goods).

In order to improve the white, the goods are finally chemicked and eventually blued; these two operations may be combined. The chemicking is effected with solutions of Chloride of Lime, either alone or with the addition of Soda, Alum etc., and according to the apparatus employed, is distinguished as steam, dry, or cylinder chemicking.

Unless otherwise stated, the Basic colours are printed according to recipe I, given below:

| Printing Recipe I. | | Printing Recipe II. | |
|--------------------|--------------------------|---------------------|---------------------------|
| { | 20 parts Colour, | { | 40 parts Colour, |
| | 70 „ Acetic acid 9° Tw.. | | 134 „ Acetic acid 9° Tw., |
| | 158 „ Water, | | 30 „ Acetine, |
| | 20 „ Acetine, | | 6 „ Tartaric acid, |
| | 600 „ Thickening St. T, | | 30 „ Glycerine, |
| | 30 „ Glycerine, | | 600 „ Thickening St. T, |
| | 2 „ Tartaric acid, | | 160 „ Acetic acid |
| | 100 „ Acetic Acid | | Tannin 1:1 |
| Tannin 1:1 | | 1000 parts. | |
| 1000 parts. | | | |

The free colour bases are printed according to Recipe II.

The most important Basic colours for calico printing are:

Methylene Yellow H, a bright yellow which resists the action of reducing agents and is fast to acid, steaming and chlorine. It is suitable for steam printing, Tannin discharge styles, and coloured discharges.

Auramine O, I and II, are pure, yellow colours, dischargeable with Chlorate. They withstand the action of reducing agents, and are used in steam printing, Tannin discharge styles and also for coloured Hydrosulphite discharges. Auramines are liable to decompose when boiled with water and acids, and also when steamed for some time.

Flavophosphine and Auroflavine are very fast to soaping, light and chlorine; they are not affected by reducing agents; consequently they are used in reduction discharges and also for Tannin discharged styles.

The Leather Yellows are fast to light and soaping: they are put on the market as free bases and also as Hydrochlorides. They are dischargeable with Chlorate but withstand the action of reducing agents and may be added to Tin Salt and Hydrosulphite discharges. Leather Yellow O is easily soluble in water, but the Leather Yellow bases are insoluble. The latter are preferred in steam printing, because they do not injure the fibre. The Leather Yellow bases are printed according to recipe II.

The Phosphines are brownish-yellow dyestuffs, fairly fast to washing, chlorine and light; they withstand the action of Tin salts but are decomposed by Hydrosulphite NF conc.

The Azophosphines are brighter in shade and faster to washing than the Phosphines; they are less fast to chlorine and light however, and are destroyed by oxidising and also by reducing agents. They are suitable for Tannin discharge styles.

Chrysoidine and Vesuvine are brown colours; they are not particularly suitable for steam colour printing because they sublimate in steaming. They are not very fast to washing, light and chlorine and are easily destroyed both by oxidising and reducing agents. They are printed according to the general recipe for Basic colours, but Senegal Gum thickening is employed instead of Starch.

The Rosazeines produce bright bluish reds on a Tannin Mordant; with Chrome Mordants the shades are bluer but not as fast. They are comparatively fast to chlorine and light but are not very fast to light. They are destroyed by oxidising agents but are stable to reducing agents.

The Safranines produce red and claret shades of good fastness to chlorine, washing and light. They are destroyed by oxidising agents, but are stable to Tin salts; Hydrosulphite turns the shades bluer. In combination with Auramine, they are used for coloured Sulphite discharges.

The Magentas are used for producing claret and cachou shades. They are fast to chlorine, fairly fast to washing but only moderately fast to light. They are destroyed by oxidising agents and hydrosulphite but are stable to Tin salts; they are employed for Tannin discharge styles.

The Methyl Violets are used especially in steam colour printing. They are fast to washing but only moderately fast to chlorine and light, and are easily dischargeable with oxidising agents. They are also destroyed by Hydrosulphite NF, but are stable to Tin salts. They are used for Tannin discharge styles.

Methylene Heliotrope O does not easily dissolve in water, but is easily soluble in Acetic acid; it is fast to chlorine, washing and light, and is used in steam colour printing. It is destroyed by oxidising agents and Hydrosulphite NF conc., but is stable to Tin salts. Methylene Heliotrope O is suitable for Tannin discharge styles.

The Marine Blues are fast to chlorine and washing and satisfactorily fast to light. They are destroyed by oxidising agents and Hydrosulphite, but are stable to Tin salts.

Victoria Blue is fast to chlorine and soaping, but only moderately fast to light. It is easily destroyed by oxidising agents and Hydrosulphite, but withstands the action of Tin salts. It is suitable for steam colour printing and Tannin discharge styles.

The Methylene Blues are noted for their satisfactory fastness to chlorine, washing and light. They are completely destroyed by oxidising agents and partially destroyed by Hydrosulphite (half discharges). They withstand the action of Tin salts. The following brands do not contain Zinc Chloride: — DRR, DBB conc., DBB extra conc.; but the brands BB extra, B conc., R conc and 3R are Zinc double compounds. New Methylene Blue N and Thionine Blue GO also belong to this group. The "D" brands, which are free from Zinc Chloride, are used in steam printing. New Methylene Blue N is especially suitable for Tannin discharge styles, because it produces a better white than the Methylene Blues after chemicking.

Induline for Printing and Acetindulines: The former are insoluble in water but easily soluble in Acetone and Ethyl Tartaric acid. The Acetindulines are Induline for Printing dissolved in Acetone. These colours are fast to light, chlorine and soaping, and are employed in steam colour printing. They are not suitable for dyeing and discharging purposes. They can be printed according to the following recipes:

| | | | | |
|---|-------------|------------------------|-------------|--------------------------|
| { | 16 parts | Induline for Printing | 100 parts | Acetinduline R conc. |
| | | R conc. powder, | | solution, |
| | 57 | „ Acetine. | 600 | „ Thickening St. T (page |
| | 600 | „ Acid Starch thicken- | | 251), |
| | | ing (page 251), | 20 | „ Acetine, |
| | 100 | „ Acetic acid 9° Tw. | 100 | „ Acetic acid 9° Tw. |
| | 97 | „ Water. | 30 | „ Glycerine, |
| | 50 | „ Tartaric acid (1:1). | 2 | „ Tartaric acid, |
| | 80 | „ Acetic acid (1:1). | 50 | „ Water, |
| | | | 100 | „ Acetic acid Tannin |
| | 1000 parts. | | | (1:1). |
| | | | 1000 parts. | |

Ethyl Blues, New Ethyl Blues and Diphen Blue are satisfactorily fast to chlorine, washing, and light, and are used in steam colour printing. The New Ethyl Blue bases are dissolved with Acetine and Tartaric acid, according to printing recipe II, page 254.

Fast Cotton Blue and New Fast Blue: These colours are fairly fast to chlorine and washing, but not very fast to alkalis and steam; therefore they cannot be used in steam colour printing. They are chiefly employed for Tannin discharge styles.

Brilliant Green and Malachite Green are fast to chlorine and acids, but not particularly fast to light. They are readily destroyed by oxidising agents and by Hydrosulphite, but are stable to Tin salts.

Methylene Green is especially fast to light, washing and chlorine. It is used in steam colour printing and for Tannin discharge styles.

Methylene Grey is fast to chlorine, washing and light, and is used in steam colour printing as well as in Tannin discharge styles. It is easily discharged by oxidising agents, but is stable to Tin salts.

B. Resisting and Discharging Basic Colours.

1. Tartar Emetic Resists.

By first printing resists containing Antimony or Zinc salts and then over-printing them with Basic steam colours, it is possible to obtain white resists.

By adding to the Tartar Emetic resists certain dyestuffs which are fixed with Acetate of Chrome (Alizarine Yellow GG etc.) coloured resists may be obtained. Tartar Emetic resists to which Citric acid, Tartaric acid or their salts have been added, are also able to resist Alizarine steam colours. Alkaline Antimony resists, or Antimony resists with reducing agents can be used for resisting a steam Aniline Black.

Reducing agents, e. g. Stannous Compounds, added to the resists serve to discharge simultaneously a ground dyed with dischargeable Dianil colours.

The white material, or goods which have been dyed with Direct Colours, are printed with the resists and then printed or padded with Basic steam colours containing some Tannin. They are then steamed for 1 hour without pressure, passed through Tartar Emetic, washed and soaped.

| White Resist 1. | | White Resist 2. | |
|-----------------|--------------------------------|-----------------|-------------------|
| 250 parts | British Gum 1.1 (page 252), | 500 parts | Gum solution 1.1, |
| 100 „ | Water, | 150 „ | Antimony Oxalate, |
| 250 „ | China Clay, | 20—50 „ | Citric acid, |
| 400 „ | Sodium Tartar Emetic. | 330—300 „ | Water. |
| 1000 parts. | | 1000 parts. | |

2. Tannin Discharge Styles.

By printing very strong alkaline discharges and then steaming them for a short time in the Mather-Platt ager it is possible to discharge Tannin or its Antimony lake; thus white patterns may be obtained on coloured grounds. The simplest method of working is as follows:

The bleached material is padded with a solution of Tannin (20—50 parts per 1000 parts of liquor) to which 20 parts of Ammonium Chloride are added, and dried in the hot flue. It is then printed with Discharge White L, steamed for 2 minutes in the Mather-Platt, passed for 1 minute at 113° F., through a bath containing Tartar Emetic (10 parts per 1000 parts of water) washed and soaped for 2—5 minutes at 113° F.

Discharge White L.

| | |
|-------------|--------------------------------|
| 230 parts | Burnt Starch, |
| 150 „ | Hot water, |
| 450 „ | Soda lye 77° Tw., add cold. |
| 170 „ | Sodium Bisulphite 66° Tw. |
| 1000 parts. | |

The goods are then dyed in 30—50 times their weight of water; 3% Tartar Emetic and 2% Alum (referring to the weight of the goods) are also added. These additions act favourably on the depth and clearness of the shade, and also on the purity of the discharged white.

After dyeing, the goods are washed, soaped, and if necessary, chemicked.

For fast shades the following dyestuffs are to be recommended: Methylene Yellow II, 10% conc., Azophosphine GO, Methylene Violet 3RA extra, Methylene Heliotrope O, Victoria Blue B, Methylene Blue DR, New Methylene Blue N, Thionine Blue GO, Fast Blue for Cotton TA I, TA II, and TA IV, Indophene Blue AE and Methylene Green extra yellow conc. Violet Crystals O can be used in small quantities for shading.

3. Tannin Half-discharged Styles.

Half-discharge effects are obtained by printing Tannin mordanted goods with Alkaline Carbonates, Silicates or Sulphites; they are then steamed for 3 minutes and dyed with Basic colours. By printing Discharge White L along with the Half-discharge, white effects, together with two half tones are produced.

Half Discharge SS.

| | |
|-------------|------------------------------|
| 220 parts | British gum powder, |
| 80 | „ China Clay paste 2:1, |
| 200 | „ Water, |
| 500 | „ Potassium Sulphite 90° Tw. |
| <hr/> | |
| 1000 parts. | |

4. Discharging by means of Oxidising Agents.

Many Basic colours are dischargeable with Chlorate, but the process is not much used because, in comparison to the Tannin discharge styles, the dyed ground is easily tendered.

5. Discharging by means of Reducing Agents.

Certain Basic dyestuffs can be destroyed by the following reducing agents: Zinc dust-Bisulphite, Sulphite, Tin salts, Stannate of Soda and Caustic Soda, and Hydrosulphite. At the present time the last mentioned is the most important.

a) Hydrosulphite Discharges.

Since the Basic colours cannot be completely destroyed by reduction, good whites cannot be obtained with Hydrosulphite discharges. These discharges can be used however, along with dyestuffs which withstand reducing agents, for the production of coloured discharges. Further particulars respecting these colours are contained on page 333 and the following pages.

b) Sulphite Discharges.

Neutral Sulphites destroy the Tannin-Antimony lakes of the following colours in steaming:

Azophosphine, Magenta, New Magenta, Methylene Blue, New Methylene Blue, Brilliant Green, Malachite Green and Methylene Green.

In this manner it is possible to produce white on light shades, but only half-discharges on dark shades. By adding to these discharges sulphite-resisting dyestuffs, which fix themselves with the Tannin of the ground colour, coloured effects are produced.

The following colours are stable to Sulphite: Auramine, Methylene Yellow H, Phosphine, Flavophosphine, Methyl Violet, Safranin, Methylene Heliotrope, Victoria Blue, Ethyl Blue, Rosazeine. By adding Caustic Soda to the Sulphite discharge (Sulphite White Discharge II) Auramine and Rosazeine 4G extra can also be discharged.

| Sulphite White Discharge I. | | Sulphite White Discharge II. | |
|----------------------------------|--------------------------------|---------------------------------|--------------------------------|
| 500 parts | Potassium Sulphite 90° Tw., | 550 parts | Potassium Sulphite 90° Tw., |
| 300 „ | British Gum powder, | 130 „ | Sulphocyanide of Potassium, |
| 200 „ | Water. | 50 „ | Caustic Soda 76° Tw., |
| 1000 parts. | | 250 „ | British Gum powder, |
| | | 20 „ | Water. |
| | | 1000 parts. | |
| Sulphite White Discharge III. | | Sulphite Coloured Discharge. | |
| 200 parts | British Gum powder, | 20 parts | Colour, |
| 100 „ | China Clay 1:1, | 200 „ | Water, |
| 600 „ | Potassium Sulphite 90° Tw., | 300 „ | British Gum powder, |
| 100 „ | Sodium Acetate. | 480 „ | Potassium Sulphite 90° Tw. |
| 1000 parts. | | 1000 parts. | |

The Sulphite discharges are printed on the dyed material, the latter then steamed for 2—3 minutes in the Mather-Platt, washed and chemicked.

c) Tin Salt Discharges.

Some Basic colours, especially the Indophene Blues and Janus Blues, are discharged red by Tin Crystals. This reaction is made use of for the production of blue-red styles. Indophene Blue R yields a bright red, which is improved by the addition of Auramine, Rosazaine 6GD extra, or Safranine to the discharge colour. The recipes are as follows:

| Discharge Red S: | | Standard White: | |
|------------------|------------------------------------|-----------------|---------------------------|
| 4 parts | Auramine conc., | 368 parts | Stannous Acetate 33° Tw., |
| 26 „ | Rosazaine 6GD extra. | 148 „ | British Gum, |
| 230 „ | Acetic acid 9° Tw., | 74 „ | Gum solution 1:1, |
| 250 „ | Acid Starch thickening (page 251), | 37 „ | Citric acid, |
| 40 „ | Tartaric acid, | 40 „ | Water, |
| 150 „ | Acetic acid Tannin solution 1:1, | 222 „ | Tin crystals, |
| 300 „ | Standard White. | 37 „ | Acetate of Soda, |
| 1000 parts. | | 74 „ | Water. |
| | | 1000 parts. | |

d) Stannate of Soda Discharges.

This discharge, in addition to its application on Turkey Red, is also suitable for the following colours in light shades: Auramine, Azophosphine GO, Rosazaine, Magenta, Methyl Violet (redder brands), Malachite Green, Brilliant Green, but Victoria Blue and Safranine resist the discharge.

c) Caustic Soda Discharges.

For this purpose Caustic Soda 76° Tw. thickened with British Gum and Water-Soluble Starch is used. Still better results are obtained if the dyed material is prepared before printing with a Glucose solution, or by adding Glucose to the Caustic Soda discharge.

2. MORDANT COLOURS

The mordant colours are acid in character when combined with Metallic Oxides, and yield coloured compounds fast to light and washing. A pronounced colour is produced only when special Metallic Oxides are employed, and the resulting colour depends entirely on these.

A. Direct or Steam Colour Printing with Mordant Colours.

The mordants used for fixing Mordant colours are Alumina, Iron and Chrome compounds; auxiliary mordants are Lime, Tin and less frequently Magnesium, Zinc or Nickel mordants, as well as the fatty mordants, notably Turkey Red Oil. The entry of fatty mordants into the colour lakes improves the fastness of the latter, and in the case of Alizarine, the beauty of the shade is also enhanced. Fatty mordants are generally used in the preparation of the material to be printed; the pieces are padded with a solution of 30–50 grms neutral Turkey Red Oil per litre (6–8 ozs. per gall). Only well sulphonated and well washed Turkey Red Oil ought to be used for this purpose.

Many attempts have been made to do away with the oiling of the goods before printing to which process is attached the disadvantage, that the white turns yellowish on steaming or storing, and also influences the hues of the accompanying colours. To this end various substances such as Turkey Red Oil, Para Soap PN, Monopole Soap, Para Acid etc. have been added to the printing colour. According to a patent of the Farbwerke, it is now possible to print Mordant colours on oiled goods, by using a new preparation brought on the market under the name of Lizarol D conc.

Lizarol D conc. is insoluble in water, and only enters into combination with the Mordant and Alizarine during steaming, producing a bright colour lake. This new preparation may also be added to most of the customary printing pastes for Alizarine Red and Pink on oiled goods, without alteration of the recipe. Where, on account of the addition of Lizarol D conc. the Pink is not blue enough with the bluish Alizarine Red brands, such as Alizarine No. I and Alizarine DIB, it is advisable to use Alizarine DIWT since this brand yields pink shades of equal brilliance to those dyed with the usual Alizarine Pink brands on oiled goods.

The printed material is steamed and afterwards washed either at full width or in rope form. For this purpose Chalk baths, Chrome baths, Malting and Soaping liquors are used; the concentration of these baths, the temperature, and duration of the treatment, are regulated according to requirements.

In order to obtain bright shades, Resorcline and Acid colours are sometimes printed with Metallic mordants, but the resulting prints are not fast to washing, and after steaming are generally finished without rinsing.

The following are the most important Mordant colours employed in Calico printing.

Alizarine Yellow brands: These give very fast greenish-yellow to yellowish-orange shades with Chrome Oxide, and can be combined with Basic colours without the addition of Tannin, producing fast shades. The fastness to washing, chlorine and light is satisfactory, but the Chrome lakes do not withstand oxidising and reducing agents. The Alizarine Yellows are used in steam colour printing and in chrome dyed styles.

| Alizarine Yellow Printing Colour: | Green Printing Colour: |
|--------------------------------------|---------------------------|
| 20 parts Alizarine Yellow | 20 parts Alizarine Yellow |
| 400 " 5G pdr., | 340 " 5G pdr., |
| 400 " Hot water. | 400 " Hot water. |
| 400 " WheatStarch Trag- | 400 " Wheat Starch- |
| acanth thickening | Tragacanth |
| (page 251), | thickening (page |
| 50 " Formic acid conc., | 50 " Formic acid conc., |
| 30 " Glycerine, | 30 " Glycerine, |
| 100 " Acetate of Chrome | 2.5 " Methylene Blue |
| 32° Tw. | DBB, |
| 1000 parts. | 57.5 " Water, |
| | 100 " Acetate of |
| | Chrome 32° Tw. |
| | 1000 parts. |

| Alizarine Yellow Printing Colour: | Red Printing Colour. |
|--------------------------------------|---------------------------|
| 30 parts Alizarine Yellow | 18 parts Alizarine Yellow |
| KR pdr., | KR pdr., |
| 295 " Water, | 8 " Rosazaine G extra, |
| 550 " Starch Tragacanth | 309 " Water, |
| thickening, | 10 " Ammonia, |
| 25 " Glycerine, | 550 " Starch Tragacanth |
| 100 " Violet Chrome Ace- | thickening, |
| tate 32° Tw. | 20 " Para Soap PN, |
| 1000 parts. | 85 " Violet Chrome Ace- |
| | tate 32° Tw. |
| | 1000 parts. |

Alizarine Orange is not very soluble in water, but is easily soluble in alkalies. The bright orange-yellow Alumina lake is not as fast to soaping as the red-brown Chrome lake. It is dischargeable with Chlorate, but fairly stable to reducing agents. It is used in steam colour printing and in dyeing. Alizarine Orange is printed according to the following recipes:

| Orange Printing Colour: | Brown Printing Colour: |
|-----------------------------------|----------------------------|
| 120 parts Alizarine Orange paste, | 100 parts Alizarine Orange |
| 79 „ Water, | paste, |
| 600 „ Thickening for Red | 245 „ Water, |
| (page 251), | 500 „ Wheat Starch Trag- |
| 110 „ Nitroacetate of Alu- | acanth thickening, |
| mina 18° Tw., | 30 „ Tournant oil, |
| 36 „ Acetate of Lime | 30 „ Glycerine, |
| 28 1/2° Tw., | 5 „ Tartaric acid, |
| 5 „ Tartaric acid, | 90 „ Acetate of Chrome |
| 50 „ Water. | 32° Tw. |
| 1000 parts. | 1000 parts. |

Alizarine Red is practically insoluble in water, but readily soluble in Ammonia, strong and weak Alkalies, Borax, Solution Ether etc. It yields very fast lakes which vary in colour according to the different mordants employed. e. g. with Alumina, Calcium and Tin mordants, red to pink shades are obtained, with Iron mordants, violet; with Chrome mordants, brownish-violet to brown shades are produced. In order to obtain mixed shades, these mordants may be combined as required. The Alizarine printing colours are steamed for 1—1 1/2 hours with or without excess pressure, washed and soaped.

| Red Printing Colour on oiled material | Red Printing Colour on unoled material. |
|--|--|
| 550 parts Thickening for Red | 550 parts Thickening for Red |
| 150 „ Water, [(page 251), | (page 251), |
| 100 „ Alizarine Red paste | 40 „ Lizarol D conc., |
| 20 „ Chlor Oil, [20%, | 120 „ Alizarine paste 20%, |
| 20 „ Stannous Hydrate | 105 „ Sulphocyanide of |
| paste 17%, | Alumina 18° Tw., |
| 20 „ Tin Oxalate 25° Tw., | 35 „ Acetate of Alumina |
| 30 „ Acetate of Lime | 18° Tw., |
| 28 1/2° Tw., | 10 „ Oxalate of Tin 25° Tw., |
| 40 „ Nitrate of Alumina | 40 „ Acetate of Lime |
| 18° Tw., | 28° Tw., |
| 70 „ Sulphocyanide of | 3 „ Tartaric acid. |
| Alumina 18° Tw. | 100 „ Water. |
| 1000 parts. | 1000 parts |
| Alizarine Pink Printing Colour on oiled material | Alizarine Pink Printing Colour on unoled material. |
| 10 parts Alizarine DIB 20%, | 400 parts Acid Starch thickening, |
| 400 „ Acid Starch thickening (page 251), | 200 „ Tragacanth, |
| 200 „ Tragacanth (60:1000), | 15 „ Lizarol D conc., |
| 369 „ Water, | 20 „ Glycerine, |
| 14 „ Nitrate of Alumina | 5 „ Alizarine DIB new 20%, |
| 18° Tw., | 45 „ Water, |
| 4 „ Acetate of Lime | 15 „ Sulphocyanide of Alu- |
| 28 1/2° Tw., | mina 18° Tw., |
| 3 „ Oxalate of Tin 25° Tw. | 2,5 „ Acetate of Lime 28° Tw., |
| 1000 parts. | 297,5 „ Water. |
| | 1000 parts. |

Alizarine Lilac Printing Colour.

| | |
|-------------------|--|
| 10 parts | Alizarine No. I 20% |
| 398 | „ Water, |
| 500 | „ Wheat Starch Tragacanth thickening (page 251), |
| { 2 | „ Yellow Prussiate of Potash, |
| { 30 | „ Water, |
| 10 | „ Acetate of Lime 28 1/2° Tw., |
| 50 | „ Acetic Acid 12° Tw. |
| <hr/> 1000 parts. | |

Alizarine Claret R paste is insoluble in water, but soluble in Alkalies. With Alumina and Lime mordants it produces claret shades, and with Chrome, dark-violet shades. Alizarine Claret R is used in steam colour printing and also for dyed styles. It is destroyed by oxidation discharges. Below we give recipes for printing:

| I. | | II. | |
|-------------------|-------------------------------------|-------------------|---------------------------------------|
| 200 parts | Alizarine Claret R paste, | 200 parts | Alizarine Claret R paste, |
| 20 | „ Water, | 150 | „ Water, |
| 400 | „ Thickening for Red (page 251), | 500 | „ Wheat Starch Tragacanth thickening, |
| 200 | „ British Gum thickening 1:1, | 150 | „ Acetate of Chrome 32° Tw. |
| 110 | „ Nitro-acetate of Alumina 18° Tw., | <hr/> 1000 parts. | |
| 70 | „ Acetate of Lime 28 1/2° Tw. | | |
| <hr/> 1000 parts. | | | |

Alizarine Blue is used for printing in the form of a Bisulphite Compound, which decomposes at 160° F and then forms insoluble Alizarine Blue. Since it is also decomposed by acids and alkalies, it is necessary to prepare the printing colour carefully. With Chrome mordants, Alizarine Blue yields fast shades similar to Indigo; the Nickel and Zinc lakes are purer but not so fast as the Chrome lake. Alizarine Blue SRX paste produces very full, bright, reddish blues with Chrome mordants. The Alizarine Blues are destroyed by Chlorate discharges. The various brands are printed according to the following recipes:

| | | | |
|-------------------|-------------------------------|-------------------|--|
| 20 parts | Alizarine Blue SB pdr. | 70 parts | Alizarine Blue SB powder, |
| 700 | „ Senegal Gum thickening 1:1, | 360 | „ Water, |
| 260 | „ Water, | 500 | „ Wheat Starch tragacanth thickening (page 251), |
| 20 | „ Acetate of Nickel 15° Tw. | 70 | „ Acetate of Chrome 32° Tw. |
| <hr/> 1000 parts. | | <hr/> 1000 parts. | |

The Philochromines give, with Chrome mordants, bright blue shades which are fast to washing and light, and fairly fast to Chlorine. They are stable to Hydrosulphite and may be used as Hydrosulphite coloured discharges. They are employed in steam colour printing and in the dyeing of Chrome mordanted goods. The printing colour is produced as follows:

| | |
|-------------|-------------------------------------|
| 200 parts | Philochromine G paste, |
| 265 „ | Water, |
| 450 „ | Wheat Starch Tragacanth thickening, |
| 25 „ | Formic acid, |
| 60 „ | Acetate of Chrome 32° Tw. |
| <hr/> | |
| 1000 parts. | |

The Chrome Violets give bright violet to violet-blue colour lakes with Chrome mordants, which are satisfactorily fast to washing, light and chlorine. They are stable to reducing agents and may therefore be used as Hydrosulphite coloured discharges; with oxidising agents they are easily discharged. They are fixed by steaming for a short time, and are very suitable for effect colours in Azo Colour styles. They are also used in steam colour printing and may further be employed for dyeing discharged, Chrome-mordanted material.

| I. | | II. | |
|-------------|--|-------------|--------------------------|
| 30 parts | Chrome Blue BMJ powder, | 35 parts | Chrome Violet VM paste, |
| 200 „ | Water, | 265 „ | Water, |
| 600 „ | Wheat Starch Tragacanth thickening (page 251), | 400 „ | Acid Starch Thickening, |
| 50 „ | Formic acid, | 200 „ | Tragacanth (60:1000), |
| 120 „ | Acetate of Chrome 32° Tw. | 100 „ | Acetate of Chrome 32° Tw |
| <hr/> | | <hr/> | |
| 1000 parts. | | 1000 parts. | |

Alizarine Green is easily soluble in water with a red, violet colour. The chrome lake is fast to washing, light and chlorine and is employed in steam colour printing. It may further be used for discharging chrome-mordanted material; it is easily dischargeable with oxidising agents.

| | |
|-------------|--|
| 150 parts | Alizarine Green S paste, |
| 650 „ | British Gum thickening 1:1 (page 252), |
| 15 „ | Water, |
| 30 „ | Glycerine, |
| 120 „ | Bisulphite of Nickel 32½° Tw., |
| 35 „ | Bisulphite of Chrome 24° Tw. |
| <hr/> | |
| 1000 parts. | |

Ceruleine is insoluble in water. It is mostly used in the form of the Bisulphite Compounds ("S" brands), which are produced by the action of Bisulphite on the colour. The Chrome lakes are fast to washing and light and fairly fast to Chlorine; they are also stable to reducing agents but are easily discharged by oxidising agents. Ceruleine is used in steam colour printing and also in Chrome dyed styles.

| I. | II. |
|--|---|
| 200 parts Ceruleine paste A or 27 parts Ceruleine conc. mixed with 173 parts water, 100 ,, Bisulphite 71 $\frac{1}{2}$ ° Tw. allowed to stand for two days, 520 ,, Wheat Starch Trag- acanth thickening (page 251), 50 ,, Glycerine, 30 ,, Tournant Oil, 100 ,, Acetate of Chrome 32 $\frac{1}{2}$ ° Tw. | 200 parts Ceruleine SW paste or 36 parts Ceruleine S conc., 240 ,, or 404 parts Water respectively, 400 ,, Wheat Starch Trag- acanth thickening, 30 ,, Glycerine, 30 ,, Oil, 100 ,, Acetate of Chrome 32 $\frac{1}{2}$ ° Tw. 1000 parts. |
| 1000 parts. | |

Alizarine Brown is almost insoluble in water, but is easily soluble in alkalis. The brown Chrome lake is fast to washing, chlorine and light; the brighter Alumina lake is not so fast as the Chrome lake. Alizarine Brown is destroyed by oxidising agents, but is fairly stable to reducing agents. The Chrome lake is used in steam printing and for Chrome dyed styles.

| |
|---|
| 100 parts Alizarine Brown paste, |
| 20 ,, Borax, |
| 316 ,, Water, |
| 500 ,, Wheat Starch Tragacanth thickening, |
| 64 ,, Neutral Chrome Mordant 32 $\frac{1}{2}$ ° Tw. |
| 1000 parts. |

Di-Nitroso-resorcine, formerly known as Solid Green O 50%, is not very soluble in cold water, but is easily soluble in alkalis, especially Ammonia, forming a brown solution. It can be produced in a simple and cheap manner by nitrating Resorcine in the printing or padding colour. It is fixed with Iron, Chrome and Nickel mordants or with Alkaline Copper solutions. In full shades the Iron lake is dark-green; the Chrome lake, brown. The dyed shades are fast to washing and light, and fairly fast to chlorine. Solutions with Ammonia produce on cotton cloth, after steaming, brown shades which, in combination with Chrome, Nickel or Copper mordants, are very fast. Oxidising and reducing agents easily destroy the colour. In dyeing, Solid Green is chiefly used for obtaining a dark green on an Iron mordant; it is also used as a steam padding colour, which is often subsequently over-printed with resists.

| Nitroso Green Printing Colour. | | Nitroso Brown Printing Colour. | |
|--------------------------------|---|--------------------------------|--|
| { | 13.6 parts | { | 21.8 parts |
| | Resorcine are dissolved in | | Resorcine are dissolved in |
| | 160 .. Ice Water and | | 186 .. Ice Water and |
| | 26.5 .. Hydrochloric acid | | 42.4 .. Hydrochloric acid |
| | 33° Tw. | | 33° Tw., |
| | Then add slowly whilst constantly stirring, the following solution: | | Then add slowly whilst stirring, the following solution. |
| { | 18.6 .. Nitrite, | { | 20.8 .. Nitrite, |
| | 151 .. Ice Water. | | 120 .. Ice Water, |
| | The whole is then stirred into: | | The whole is then stirred into: |
| | 500 .. Tragacanth | | 500 .. Tragacanth |
| | (60 : 1000), | | (60 : 1000), |
| | 80 .. Yellow Prussiate of Potash, | | 40 .. Caustic Soda |
| | 50 .. Ammonia. | | 76° Tw., |
| | | | 60 .. Ammoniacal Copper Sulphate. |
| 1000 parts | | 1000 parts. | |

Ammoniacal Copper Sulphate.

| | |
|-------------|------------------|
| 50 parts | Copper Sulphate, |
| 875 .. | Water, |
| 75 .. | Ammonia 25%. |
| 1000 parts. | |

The Rosazeines, Eosines, Phloxines etc. give bright red to pink coloured lakes with Chrome mordants; these lakes are not very fast to washing and light, but are used on account of their bright shades. These colours can also be resisted with Citric acid, Tartaric acid, and their alkaline salts.

The printing recipe is as follows:

| | |
|-------------|--------------------------------|
| 30 parts | Eosine extra yellow, |
| 245 .. | Water, |
| 600 .. | Tragacanth (60 : 1000), |
| 90 .. | Acetate of Chrome 32 1/2° Tw., |
| 35 .. | Acetic acid 9° Tw. |
| 1000 parts. | |

Acid Colours.

Acid colours are very rarely used in steam colour printing, since they are not fast to washing. They are printed with the addition of Chrome or Alumina mordants, steamed for 1 hour and finished without washing.

The printing recipes are as follows:

| | |
|-------------------------------------|--|
| 30 parts Alkaline Blue 2B, | 30 parts Victoria Scarlet 3R, |
| 170 „ Water, | 245 „ Water, |
| 700 „ Thickening BRW (page 251), | 600 „ Wheat Starch Traga- canth thickening (page 251), |
| 50 „ Para acid, | 125 „ Acetate of Alumina |
| 50 „ Bisulphite of Chrome | 23° Tw. |
| 32 1/2° Tw. | |
| 1000 parts. | 1000 parts. |

B. Printing and Padding with Mordants and subsequent Dyeing with Mordant Colours.

The mordanting of cotton can be effected either by printing or dyeing.

The most important mordants are Alumina, Iron and Chrome mordants.

I. Alumina Mordant.

a) Printing Colour.

| |
|-------------------------------------|
| 80 parts Wheat Starch, |
| 40 „ Water, |
| 50 „ Burnt Starch, |
| 800 „ Acetate of Alumina 10 1/2° Tw |
| 15 „ Olive Oil, |
| 15 „ Turpentine. |

1000 parts, boil, allow to cool, and strain.

In order that the mordant may thoroughly penetrate the material, a Flour thickening is used instead of Starch, and the colour printed on with the application of a Gum roller.

b) Padding Mordant.

For this purpose thickened solutions of Acetate of Alumina, Sulphate Acetate or Basic Sulphate of Alumina of 9–12° Tw. are used. The thickening agent is Burnt Starch, Leigomme, or Tragacanth.

The addition of small amounts of Tin Compounds to the printing or padding colour makes the shade yellower and increases the brightness of Alizarine Red. After printing or padding, the mordant is fixed by hanging the pieces in the oxidation chamber at 97° F. and 90° humidity, whereby any Oxidation Aniline Black which was printed along with the Mordant colour, is developed. The latter can also be fixed by passing the goods through the Mather-Platt ager, and then for a short time through an Ammonia box, after which the material is dunged.

The object of “dunging” is to fix the mordant and get rid of the thickening.

The “dunging” baths generally contain Chalk, Silicate of Soda, Phosphate of Soda, or sometimes also Cow-dung in varying proportions. Malt likewise, especially in the second “dunging” bath, offers advantages.

"Dunging" Bath No. 1.

440 gallons Water,
 44 lbs. Chalk,
 176 „ Cow-dung,
 4 lbs. 6 ozs. Phosphate of Soda crystals.

The goods are passed open through this bath at 140° F. for 2 minutes and are then well washed. Then follows:

"Dunging" Bath No. 2.

110 gallons Water,
 4 lbs. 6 ozs. Chalk,
 22 „ Cow-dung.

The goods are worked in this bath in rope form for 20–30 minutes at 120–140° F., and are then thoroughly washed.

In order to obtain a brilliant red together with a pure white, well bleached material (test by dyeing a piece of the unprinted material with Alizarine), perfect fixation of the mordants during "ageing" and "dunging", as well as thorough cleansing of the whole by washing, are absolutely necessary.

The goods are then dyed with Alizarine Red, with the addition of Tannin, Glue, Sumach, Blood Albumen, Turkey Red Oil etc., which partly increase the depth of the red, and partly influence the purity of the white.

The water must be absolutely free from Iron and not too hard. Water containing too little Lime is corrected by the addition of Chalk; a water of 7.5° hardness is very suitable for dyeing Alizarine Red. To obtain a pure white along with a deep red, an excess of colour in the dyebath must be strictly avoided. In order to judge the progress of the dyeing operation, small pieces of cloth, printed with Alumina mordant, are sewn on to the pieces to be dyed, and from their appearance the duration of the dyeing operation can be judged.

The dye liquor must be quite clear after dyeing, and must not show the Alizarine reaction on the addition of Caustic Soda to a small sample of it.

Dyebath for 100 lbs. of Material:

7 lbs. 8 ozs. Alizarine Red paste 20%,
 12 „ Sumach Leaves,
³/₄—1 „ Glue,
 2 „ 8 „ Turkey Red Oil 75% (sulphoricinoleate, half neutralised),
 1 „ Chalk,
 200 gallons Water.

The goods are treated for ¹/₂ an hour cold, 20 minutes at 104° F., and then the temperature is raised within 20 minutes to 140° F. and within a further 20 minutes to 167° F.; they are then well washed, treated for 10 minutes at 140° F. in a bath containing 4 ozs. of Bran per gallon, washed again and dried.

In order to convert the brownish-Alizarine Red lake into the bright red, the pieces are oiled with Turkey Red oil 50% (8 ozs. per gallon) dried, steamed and finally soaped.

Additions of Oxalate of Ammonia or Arseniate of Soda produce a better white; consequently the following oiling bath is used:

| | | |
|-----|---------|--|
| 4 | gallons | Water, |
| 3—4 | lbs. | Ammonia Turkey Red Oil, |
| 6 | ozs. | Oxalic acid, |
| 3/4 | gallon | Water; the whole neutralised with Ammonia |

and made up to 5 gallons.

After this treatment the goods are steamed for 1 hour at $1\frac{1}{2}$ atm. pressure, then soaped for 10—30 minutes at 140° F. with 2 parts of Soap and 0.5 parts of Tin salts per 1000 parts of liquor. After soaping, the goods are generally steam-chemicked to clear the white.

The following colours are used for Alumina dyed styles: — Alizarine Orange, Alizarine Red, Alizarine Brown, Alizarine Claret.

For the production of Turkey Red, dyed red, black-red and red discharge styles, the "New Red" process is employed.

2. Chrome Mordants.

Beautiful effects are obtained if the bleached material is twice padded with Light Chrome mordant, dried without previous washing, passed once through 3% Soda solution, washed and then dried.

Discharge White ZW (page 273) and Dark Chrome Printing Colour are now printed on a weak chrome mordant; the goods are then steamed gently for 1 hour and finally well washed.

| | |
|-------------------------|------------------------------|
| Light Chrome Mordant: | Dark Chrome Printing |
| 80—120 parts by weight, | Colour: |
| Chrome Mordant | 700 parts Thickening for Red |
| GA II 64° Tw, | (page 251), |
| 920—880 „ by weight, | 300 „ Acetate of Chrome |
| Water. | 32 $\frac{1}{2}$ ° Tw. |
| 1000 parts. | 1000 parts. |

Chrome Mordant GA II for dark shades:

| | |
|-----------|-------------------------------|
| 200 parts | Chrome Mordant GA II 64° Tw., |
| 30 „ | Glycerine, |
| 770 „ | Water. |

1000 parts.

The bleached material is impregnated with the Chrome Mordant on the padding machine, dried in the hot flue, aged for 1—2 minutes in the Mather-Platt, passed at full width through a 3% solution of Soda at 140 — 176° F., washed and dyed. Pieces impregnated with Chrome Mordant GA II must not be allowed to lie for any length of time exposed to the light.

The Alkaline Chrome Mordants of Horace Koechlin and Henri Schmid are also used.

| Alkaline Chrome Mordant I. (Koechlin.) | Alkaline Chrome Mordant II. (Schmid.) |
|--|---|
| 250 parts Acetate of Chrome | 150 parts Chrome Alum are precipitated with |
| 32 $\frac{1}{2}$ ° Tw., | 50 „ Soda calc. The precipitate is washed and then dissolved in |
| 320 „ Soda lye 72° Tw., | 750 „ Caustic Soda 52° Tw. |
| 10 „ Glycerine 52 $\frac{1}{2}$ ° Tw., | |
| 420 „ Water. | |
| 1000 parts. | |

The goods are padded with these mordants, rolled up, allowed to lie for a few hours, washed and dried.

Besides these mordants, Chromium Bisulphite is also used.

The goods are padded with Chromium Bisulphite, "batched" and allowed to lie for 2 hours; they are then dried, steamed in the Mather-Platt, passed through Soda and washed.

The dyebath is prepared with the necessary amount of colour and a little Acetic acid. The goods are dyed for 20 minutes in a cold bath; the temperature is then gradually raised to the boil within 1 hour, and dyeing continued at the boil for about 20 minutes longer or until the dyebath is exhausted.

The following colours may be used for Chrome dyed styles:

| | |
|---------------------------------|---------------------------------|
| Alizarine Yellow 5G, GG, R, | Alizarine Blue, all brands, |
| KR, | Alizarine Green S powder and |
| Mordant Yellow O, | paste, |
| Alizarine Orange, all brands, | Ceruleine, all S (Bisulphite) |
| Alizarine Red, all brands, with | brands, |
| the exception of the "S" | Galleine, all brands, |
| brands, | Philochromine B paste, G paste, |
| Alizarine Claret R, | Chrome Violet, all brands, |
| Alizarine Brown, all brands, | Solid Green O 50°/o paste. |

3. Iron Mordants.

The most generally employed Iron mordants are Ferrous Compounds which are converted on the fibre into Ferric Oxides, either by oxidation in the air or by steaming. Concentrated Iron mordants are liable to injure the fibre during the oxidation.

The Iron mordant most frequently used is Pyrolignite of Iron, either alone or in conjunction with Alumina or Chrome mordants. Sometimes small amounts of Arsenic Compounds such as Arsenic Glycerine, Ammonium Chloride etc. are also added to the mordant.

The following colours are suitable for dyeing on Iron mordants:

Alizarine Red, all brands except the "S" brands
Solid Green 10°/o

Iron Mordant for Solid Green 10°/o.

| |
|--------------------------------------|
| 55 parts Resorcline, |
| 400 „ Ice Water, |
| 106 „ Hydrochloric acid 36° Tw., |
| to which are added, whilst stirring, |
| 75 „ Sodium Nitrite, |
| 364 „ Ice Water. |

1000 parts.

After padding and drying the goods in the hot flue, they are hung in a damp oxidising chamber for 24 hours at 90° F. and 28° humidity, or they are oxidised in the ager or Mather-Platt. They are then treated for 3 minutes at 140° F. in a bath containing 2 parts Sodium Phosphate and 30 parts of Chalk per 1000 parts of liquor, washed in water free from Lime without the addition of acid, and dyed with 30—50% Solid Green 10%.

Printing Colour for dyed Alizarine Lilac shades:

| | |
|-------------------|-----------------------------|
| 350 parts | British Gum powder, |
| 570 „ | Water, |
| 50 „ | Glycerine, |
| | Add cold, |
| 30 „ | Pyrolignite of Iron 22° Tw. |
| <hr/> 1000 parts. | |

The treatment of the goods after printing and up to the dyeing process is exactly as described above. The goods are then dyed with Alizarine Red (blue shade), with the addition of Methyl Violet. Sumach or Tannin help to fix the Methyl Violet.

The cleansing of the white by malting, soaping and chemicking is done exactly in the same manner as for Alizarine Red.

Alumina-Iron Mordant.

| | |
|-------------------|------------------------------|
| 870 parts | Acetate of Alumina 9° Tw., |
| 100 „ | Pyrolignite of Iron 15° Tw., |
| 30 „ | Glycerine. |
| <hr/> 1000 parts. | |

The Alumina-Iron mordant is used for the production of dark brown shades by means of Alizarine alone, or in conjunction with Sumach, Fustic and Logwood.

Chrome-Iron Mordant.

| | |
|-------------------|-------------------------------|
| 80 parts | Chrome Mordant GA II 64° Tw., |
| 120 „ | Pyrolignite of Iron 15° Tw., |
| 30 „ | Glycerine. |
| <hr/> 1000 parts. | |

This mordant is used for the production of dark brown shades with Alizarine Brown, and for dark blue shades with Alizarine Blue. The treatment is exactly the same as described for Alumina and Chrome mordants.

4. Steam Padding Colours with Mordant dyestuffs. (Erban Specht's process.)

This process was described in the chapter on cotton dyeing (page 150).

C. Resisting and Discharging Mordant Colours.

1. Resists under Alizarine Steam Colours.

The following substances are used as resisting agents; Tartaric acid, Citric acid, Oxalic acid and their alkali salts; also Oxalate of Antimony, which latter may also be used for resisting Tannin dyestuffs.

The resists are printed by themselves or along with Alizarine colours on cloth prepared with Turkey Red oil and then over-printed with Alizarine colours. The goods are then steamed for 1—1½ hours without pressure, passed through chalk, washed and soaped.

White Resist for Steam Alizarine Pink and Violet.

| | |
|-------------|-----------------------------|
| 300 parts | British Gum powder, |
| 600 „ | Water, |
| 30 „ | Citric acid, |
| 50 „ | China clay, |
| 20 „ | Citrate of Soda 48 1/2° Tw. |
| 1000 parts. | |

Alizarine Pink for Padded styles on oiled material:

| | |
|-----------|------------------------------------|
| 400 parts | Acid Starch thickening, |
| 200 „ | Tragacanth 60 : 1000, |
| 20 „ | Glycerine, |
| 7.5 „ | Alizarine DIB new paste 20 0/0, |
| 351 „ | Water, |
| 15 „ | Sulpho Cyanide of Alumina 18° Tw., |
| 3 „ | Acetate of Lime 18° Tw., |
| 2 „ | Oxalate of Tin 25° Tw. |

1000 parts

Alizarine Pink for Padded styles on unoled material:

| | |
|-----------|------------------------------------|
| 400 parts | Acid Starch thickening, |
| 200 „ | Tragacanth 60 : 1000, |
| 15 „ | Lizarol D conc , |
| 20 „ | Glycerine, |
| 7.5 „ | Alizarine DIB new paste 20 0/0, |
| 332 „ | Water, |
| 15 „ | Sulpho Cyanide of Alumina 18° Tw., |
| 4 „ | Acetate of Lime 25° Tw., |

1000 parts.

Alizarine Violet for padded styles on unoled material.

| | |
|----------|-------------------------------------|
| 20 parts | Alizarine Red DIB new paste 20 0/0, |
| 126 „ | Water. |
| 700 „ | Gum solution 1:1, |
| 80 „ | Acetic acid 9° Tw , |
| 20 „ | Acetate of Lime 25° Tw., |
| 4 „ | Yellow Prussiate of Potash, |
| 50 „ | Water. |

1000 parts.

2. Discharging Mordants with fixed organic Acids and subsequent dyeing.

a) White discharge for Alumina dyed styles.

In order to produce discharge effects on an Alumina mordant the cloth is padded with the mordant as described on page 267, dried, and then printed with the discharge white, either alone or along with Oxidation Aniline Black; the mordant is then fixed by "ageing" or steaming for a short time and "dunnging". The white discharge colour consists of Citric acid or Tartaric acid, alone, or mixed with the Alkaline salts, China clay and sometimes Bisulphate. With weaker white discharges, so called "half-discharges" are obtained, e. g. Pink on Red.

Discharge White ZN.

| | | |
|-----------|-------------------|--------------|
| 150 parts | China clay | 1:1, |
| 150 | „ Citric acid, | |
| 100 | „ Citrate of Soda | 52 1/2° Tw., |
| 600 | „ Gum solution | 1:1. |
| <hr/> | | |
| 1000 | parts. | |

Colours suitable for dyeing discharged Alumina mordants are :

Alizarine Orange, all brands,
Alizarine Red, all brands except the "S" brands,
Alizarine Claret paste,
Alizarine Brown paste.

b) White discharge for Chrome dyed styles.

For discharging Chrome Mordant GA II (page 269) the following discharge white is used:

Discharge White Z for dark shades.

| | | |
|-----------|----------------------------|------|
| 100 parts | China Clay | 1:1, |
| 150—200 | „ Citric or Tartaric acid, | |
| 750—700 | „ Gum solution | 1:1. |
| <hr/> | | |
| 1000 | parts. | |

After printing, the goods are steamed for about 5 minutes, passed through a Soda solution (30 parts per 1000) at 122° F. well washed and dyed.

Discharge white ZW for light Chrome Mordant
(page 269).

| | | |
|-----------|------------------|------|
| 800 parts | Gum solution | 1:1, |
| 181 | „ Water, | |
| 10 | „ Citric acid, | |
| 9 | „ Tartaric acid, | |
| <hr/> | | |
| 1000 | parts. | |

The dyeing with Alizarine colours and the subsequent treatments are carried out in the usual way. For example, the dyebath is prepared with 3% Alizarine Orange paste.

c) White discharge on Iron mordant.

The material, mordanted with the Iron mordant described on page 270, is printed with the same discharge white that is recommended for Alumina mordants, which may be made rather stronger if necessary; it is then fixed in the usual way, and dyed with Solid Green or Alizarine colours.

d) White discharge on Alumina-Iron mordant.

The material is padded with the Alumina-Iron mordant given on page 271, printed with the discharge white used for Alumina mordants, and further treated in the manner stated for Alumina dyed styles.

The bluer shades of Alizarine Red are used for dyeing.

3. Discharging the Steam Padding Colours prepared with solutions of Mordant dyestuffs.

The steam padding colours produced with Alizarine dyestuffs are discharged by means of fixed organic acids or their alkaline salts, Antimony Oxalate, or with oxidising agents.

The Antimony Oxalate discharge can, at the same time, serve as a resist for Tannin colours. The oxidation discharges are chiefly employed for Alizarine Chrome padding colours. The strength of the discharges varies according to the depth of the shade.

After printing, the goods are steamed in the Mather-Platt or in the steam box, then washed, soaped and chemicked. The following are some recipes for discharge pastes:

| Discharge White 1. | Discharge White 2. |
|-----------------------------|----------------------------------|
| 800 parts Gum Solution 1:1. | 700 parts British Gum thickening |
| 100 „ Tartaric acid. | 1:1. |
| 100 „ Citric acid | 200 „ Caustic Soda 72° Tw. |
| 1000 parts. | 100 „ Citric acid. |
| | 1000 parts. |

Reduced as required from 1 1 to 1:4

| Discharge White 3. | Discharge White 4 |
|-----------------------------|-----------------------------|
| 550 parts Gum solution 1:1, | 840 parts Gum solution 1:1, |
| 150 „ Antimony Oxalate. | 120 „ Antimony Oxalate, |
| 1000 parts. | 40 „ Tartaric acid. |
| | 1000 parts. |

Discharge White 5.

200 parts British Gum,
600 „ Potassium Sulphite 91° Tw. are heated and
200 „ Citrate of Ammonia 46° Tw. added cold.
1000 parts.

For Chlorate discharge see page 342.

4. Discharging dyed Mordant Colours.

a) Discharging Turkey Red by means of Chloride of Lime.

The dyed material in printed with thickened organic acids, e. g. Citric acid, or Arsenic acid for discharge white; with Citric acid and Lead salts for discharge yellow; or with Tartaric acid and a solution of Prussian Blue in Oxalic acid for discharge blue. By mixing discharge blue and yellow, discharge green is obtained. After printing, the goods are passed through a system of roller cisterns, the first containing a 10% solution of Chloride of Lime (saturated with Lime), and the others, running water. After passing through the Chloride of Lime bath, which effects the discharge, the yellow and green are developed in a weak, luke-warm chrome bath. Instead of Citric, Tartaric, Oxalic or Lactic acid may be used with advantage.

b) Discharging Turkey Red by the Glucose-Alkali process.

The dyed goods are prepared with a strong Glucose solution and quickly dried: they are then printed with strong Alkaline printing colours.

| Discharge White ZT I. | | Discharge White ZT II. | |
|-----------------------|--|------------------------|--|
| 100 parts | Tin Salts are added at a temperature not exceeding 95° F. to | 55 parts | Tin Salts, |
| 700 „ | Alkaline thickening ZT then | 35 „ | Sulphate of Zinc, |
| 200 „ | Silicate of Soda 72—77° Tw. are added. | 75 „ | Glycerine, |
| | | 157,5 „ | Gum solution 1:1, |
| | | 535 „ | Caustic Soda 100° Tw. |
| | | 125 „ | Silicate of Soda 52° Tw. |
| | | 15 „ | Turpentine, |
| | | 2,5 „ | Indigo MLB paste 20‰. |
| 1000 parts. | | 1000 parts. | |
| Discharge Yellow ZT. | | Discharge Green ZT. | |
| 600 parts | Alkaline Thickening ZT, | 800 parts | Discharge Yellow ZT without Silicate solution, |
| 20 „ | Water, | 100 „ | Discharge White ZT II, |
| 200 „ | Hydroxide of Lead paste 50‰, | 100 „ | Indigo MLB paste 20‰. |
| 80 „ | Silicate of Soda 52° Tw. | 1000 parts. | |
| 1000 parts. | | | |

The bleaching solution is prepared in the clear liquor of a 10‰ Milk of Lime paste.

| Discharge Blue ZT. | | Alkaline Thickening ZT. | |
|--------------------|------------------------|-------------------------|-----------------------|
| 180 parts | Gum solution 1:1, | 165 parts | Yellow Dextrine. |
| 550 „ | Caustic Soda 106° Tw., | 835 „ | Caustic soda 106° Tw. |
| 20 „ | Starch, | 1000 parts | |
| 40 „ | Water, | | |
| 35 „ | Glycerine. | | |
| 15 „ | Turpentine, | | |
| 160 „ | Indigo MLB paste 20‰. | | |
| 1000 parts. | | | |

After printing, the goods are thoroughly dried, immediately and vigorously steamed for 2—3 minutes in the Mather-Platt, then passed through a boiling bath of silicate of Soda (20 parts per 1000) and washed. The pieces are then chromed in an acidified bath of Potassium Bichromate, again washed and dried. In order to simplify this process, the Glucose may be added direct to the discharge colour; these discharge colours are, however, not very stable.

c) Discharging Turkey Red by means of Hydrosulphite and Caustic Soda.

This process is used for the so-called "Blue-red" styles. The dyed pieces are printed with Indigo, Caustic Soda and Hydrosulphite, steamed for 2—3 minutes in the Mather-Platt, washed in running water to re-oxidise the Indigo, and finally soaped.

Indigo Discharge Colour Z.

75 parts Indigo NF, conc. are dissolved in
 125 „ Water, cooled solution added in several portions to
 450 „ Alkaline Thickening, then
 150 „ Indigo MLB paste 20% which have been stirred into
 200 „ cold alkaline British Gum thickening, are added.
 1000 parts.

d) Discharging dyed Mordant Colours by means of Chlorate discharges.

Alizarine colours dyed upon chrome mordanted material are printed with Chlorate discharge, steamed for 1-3 minutes in the Mather-Platt, then passed through a Chalk bath, washed and soaped.

The following colours are discharged by Chlorates:

Alizarine Orange, all brands,
 Alizarine Red, all brands (except the "S" brands),
 Alizarine Claret R paste.
 Alizarine Brown, all brands,
 Alizarine Blue, all brands,
 Alizarine Green S powder and paste.
 Alizarine Yellow KR,
 Galleine, all brands,
 Ceruleine, all brands,
 Solid Green O paste 50%.

Suitable Chlorate discharges are given on pages 340 and 342.

III. DIRECT DYEING COLOURS.

In consequence of the great affinity of these colours for the vegetable fibres, they yield fairly fast shades without the assistance of mordants. In printing, the Direct (Dianil) colours are used for direct and also for discharge printing.

A. Direct or Steam Colour Printing.

The Direct colours are only little used for steam colour printing, since they are not fast to washing and the shades are not sufficiently bright. They are printed with the addition of Turkey Red oil, Sodium Phosphate or Albumen. After printing, the goods are steamed for 1 hour with moist steam, washed, and then soaped for a short time in a lukewarm soap bath. An aftertreatment with Solidogen A renders the colours faster to washing.

These dyestuffs are applied according to the following recipe:

40 parts Colour,
 490 „ Water,
 150 „ British Gum,
 200 „ Tragacanth 60 : 1000.
 40 „ Sodium Phosphate,
 30 „ Glycerine,
 50 „ Turkey Red oil.
 1000 parts.

B. Padding and Dyeing with Direct Colours.

For the production of plain shades frequently no further preparatory treatment takes place besides singeing. The unprepared goods are entered direct into the dye-bath. For medium shades the goods are first boiled with Soda, and for light shades half or full bleached material is used. A full bleach is necessary for printed goods, especially for discharge styles. Further particulars respecting this method of dyeing are given on page 116 etc., in the chapter on Cotton Dyeing.

1. Mercerisation by printing of thickened Caustic Soda lye and subsequent dyeing with Dianil Colours.

If white goods are printed with thickened Soda lye, washed, and then dyed with Dianil colours, dark and light shades are obtained at the same time by local mercerisation; the goods must be dyed at a low temperature. The printing colour used is Alkaline Thickening B, page 252.

2. Damask effects on goods padded with Dianil Colours.

Damask effects are produced by printing Oxide of Zinc and Albumen on goods previously padded in light shades with Dianil colours. After printing, the goods are steamed in the Mather-Platt and then finished without being washed. The printing colour is made up as follows:

| | |
|-------|-------------------------|
| 300 | parts Oxide of Zinc, |
| 50 | „ Glycerine, |
| 300 | „ Egg Albumen 1:1. |
| 250 | „ Tragacanth (60:1000). |
| 75 | „ Olive oil, |
| 25 | „ Turpentine. |
| <hr/> | |
| 1000 | parts. |

C. Discharging Dianil Colours.

The principal use of Dianil colours in printing is based on the easy dischargeability of these dyestuffs by means of reduction and oxidation discharges.

According to the reducing agent employed, the following discharges are to be distinguished:

1. Tin Salt discharges,
2. Zinc Dust discharges,
3. Hydrosulphite discharges.

For oxidation discharges Chlorates are used.

1. Tin Salt Discharges.

The salts used for Tin discharges are Tin Crystals, Acetate of Tin and Stannous Oxide. For the protection of the fibre Sodium Acetate or Ammonium Sulphocyanide with Citric or Tartaric acid is added to the tin salt colours.

Ammonium Chloride and Ammonium Tartrate are added to the Stannous Oxide discharges.

The following are recipes for white discharges with Tin salts:

| Discharge White 1. | | Discharge White 2. | |
|------------------------------|------------------------------------|-------------------------------|----------------------------|
| 450 parts | Acid Starch thickening (page 251), | 80 parts | Wheat starch, |
| 275 „ | Tin salts, | 80 „ | Water, |
| 75 „ | Acetic acid 9° Tw., | 250 „ | Dextrine, |
| 125 „ | Acetate of Soda crystals, | 550 „ | Stannous Acetate |
| 75 „ | Tragacanth (60:1000). | 32½° Tw., | |
| | | 40 „ | Citric acid. |
| 1000 parts. | | 1000 parts. | |
| Suitable for short steaming. | | Suitable for longer steaming. | |
| Discharge White 3. | | Discharge White 4. | |
| 110 parts | Wheat starch, | 400 parts | Acid Starch thickening. |
| 820 „ | Stannous Acetate 32½° Tw., | 100 „ | Tragacanth 60:1000. |
| 70 „ | Acetic acid 9° Tw. | 240 „ | Tin salts, |
| 1000 parts. | | 100 „ | Water, |
| Boil well. | | 100 „ | Sulpho Cyanide of Ammonia. |
| | | 60 „ | Citric acid 36° Tw. |
| | | 1000 parts. | |

Discharge White 5.

| | |
|-------------|-------------------------------|
| 40 parts | Wheat starch, |
| 290 „ | Water, |
| 100 „ | British Gum powder, |
| 320 „ | Stannous Oxide paste 23%, |
| 150 „ | Tartrate of Ammonia 32½° Tw., |
| 100 „ | Chloride of Ammonia. |
| 1000 parts. | |

A good white is also obtainable with the above discharges reduced as well.

Coloured Tin discharges contain, besides Stannous Acetate, Basic dyestuffs and Tannin or Pigment colours with Albumen.

| Coloured Discharge 1. | | Standard White Z. | |
|-----------------------|---------------------------------------|-------------------|--|
| 30 parts | Colour, | 368 parts | Stannous Acetate 32½° Tw., |
| 230 „ | Acetic acid 9° Tw., | 148 „ | British Gum powder, |
| 250 „ | Acid starch thickening, | 74 „ | Gum solution 1:1, |
| 40 „ | Tartaric acid, | 37 „ | Citric acid, |
| 150 „ | Acetic acid Tannin solution 1:1, then | 40 „ | Water, boiled for 10 minutes, then |
| 300 „ | Standard White Z are added. | 222 „ | Tin salts are added, the whole stirred for 5 minutes, when cold, |
| 1000 parts. | | 37 „ | Sodium Acetate crystals and |
| | | 74 „ | Water are added. |
| | | 1000 parts. | |

Coloured Discharge with Pigment Colours.

Coloured discharge II.

| | |
|-------------------|--------------------------------|
| 200 parts | Chrome Yellow paste. |
| 100 „ | Albumen solution 1:1, |
| 700 „ | Discharge White 5 (see above). |
| <hr/> 1000 parts. | |

The following colours can be used in coloured discharges. Methylene Yellow H, Auramine, Flavophosphine, Phosphine, Leather Yellow, Magenta, Rosazene 4G extra, 6G extra, 6GD extra, Rosazene Scarlet G extra, Methylene Heliotrope, Methyl Violet, Marine Blue, Methylene Blue, Ethyl Blue, Victoria Blue, Brilliant Green, Malachite Green, Methylene Grey.

The goods, previously dyed with Dianil colours, are printed with the white or coloured discharge, and steamed. The duration of the steaming depends on the depth of the shade and also on the strength of the discharge colour; it is usually carried out in the Mather-Platt, since if the goods are steamed for too long a time, the white is liable to turn yellow. After steaming the goods are well washed and finally soured in a weak acid bath.

2. Zinc Dust Discharges.

The dischargeability of the Dianil colours with Zinc dust discharges is, generally speaking, equal to that of the Tin discharges, and surpasses it in many cases as regards the purity and stability of the white.

After printing, the goods are steamed for $\frac{1}{2}$ an hour, then soured cold with 5 parts Hydrochloric acid 36° Tw. per 1000, and thoroughly washed.

For coloured Zinc dust discharges the following dyestuffs can be used: Oxydianil Yellow O, Phosphine, Rosazene, Safranine and Methylene Heliotrope O.

Discharge White 1.

| | |
|-------------------|----------------------------|
| 250 parts | Zinc dust, No. I. quality, |
| 450 „ | Gum solution 1:1. |
| 50 „ | Glycerine, |
| 50 „ | Ammonia, |
| 200 „ | Sodium Bisulphite |
| | 66 $\frac{1}{2}$ ° Tw. |
| <hr/> 1000 parts. | |

Discharge White 2.

| | | |
|-------------------|-----------|----------------------------|
| { | 250 parts | Zinc dust, No. I. quality, |
| | 200 „ | Gum solution 1:1, |
| | | are finally ground and |
| | | whilst cooling, |
| | 400 „ | Sodium Bisulphite |
| | | 66 $\frac{1}{2}$ ° Tw., |
| | | slowly added; when |
| | | the reaction is |
| | | complete, |
| { | 30 „ | Soda, |
| | 70 „ | Water, |
| | 50 „ | Glycerine, are added. |
| <hr/> 1000 parts. | | |

| Discharge White 3. | Discharge White 4. |
|----------------------------|--------------------------|
| 250 parts Zinc dust, | 400 parts Zinc dust, |
| 230 „ Potassium Sulphite | 200 „ Potassium Sulphite |
| are finely ground and | 91° Tw., |
| whilst cooling, | 100 „ Glycerine, |
| 460 „ Sodium Bisulphite | 300 „ Gum solution. |
| 66 1/2° Tw., | 1000 parts. |
| 70 „ Formaldehyde 40°. | |
| 50 „ Glycerine, are added. | |
| 1000 parts. | |

3. Hydrosulphite Discharges.

The most important discharges for Dianil colours are those produced with Hydrosulphite NF or NF conc. Most Dianil colours are easily dischargeable with Hydrosulphite, even in dark shades. Since the Hydrosulphite discharges are applicable to a great variety of dyestuffs, their employment is described in a separate chapter, pages 316 and following.

4. THE THIOPENE COLOURS.

The prints produced with Thiopene colours are distinguished as regards fastness to washing and light, but their fastness to Chlorine is not satisfactory, with the exception of Thiopene Cyanine.

For discharge and resist purposes the usual brands employed in plain dyeing are used, but for Direct printing special products ("D" brands) are used. These latter are free from Sulphur and Alkaline-Sulphur compounds, and consequently do not corrode or blacken the copper rollers. The "D" brands possess the same fastness properties as the ordinary brands. The following "D" brands are now on the market:

| | |
|----------------------------------|---------------------------------|
| Thiopene Black MD conc., | Thiopene Rubine O extra strong. |
| Thiopene Grey BD extra strong | Thiopene Yellow GGD conc. |
| Thiopene Blue BD conc., | Thiopene Green GLD extra |
| Thiopene Cyanine GD conc., | conc. |
| Thiopene Cyanine OD conc., | Thiopene Brown GCD conc., |
| Thiopene Violet BD extra strong. | Thiopene Brown GRD conc., |
| | Thiopene Brown SD conc. |

A. Direct Printing.

The Thiopene dyestuffs, like Indigo, form leuco compounds, and can therefore be fixed in printing like the vat colours, by means of Alkaline reducing agents such as Glucose, Hydrosulphite NF conc. and Hydrosulphite conc. powder: the presence of strong Caustic Alkalies, owing to their mercerising action, increases very considerably the fixation of the Sulphur colours. Strongly alkaline printing pastes are especially suitable for dark colours; light colours may be printed with a small amount of Caustic Soda or with Potash. On account of their rapid fixation, the Thiopene colours are suitable for printing along with Para Red etc. especially for "raised" styles, since this property of the fibre is not affected.

Thiogene Violet and Thiogene Rubine yield redder and brighter shades with Hydrosulphite conc. powder than with Hydrosulphite NF. conc., whilst Thiogene Cyanine produces darker shades with Hydrosulphite NF conc. The other Thiogene colours such as black, grey, blue, green, brown and yellow fix equally well with both Hydrosulphite preparations. It is advisable, therefore, to use the two together, whereby cheap, and at the same time, durable printing colours are obtained.

The printing colour is made up as follows:

The dyestuff is made into a paste with Water, Glycerine, China clay paste, Caustic soda and Hydrosulphite, and heated on the water-bath until the dyestuff is reduced and completely dissolved. To the dyestuff solution is now added an Alkaline thickening, and the whole heated again to 122° F. The addition of Glycerine is advantageous.

a) Strong Alkaline Printing Colours

| Blue 1. | | Blue 2. | |
|-------------|---|-------------|---|
| 10 parts | Thiogene Cyanine GD conc., | 30 parts | Thiogene Blue BD conc., |
| 25 " | Glycerine, | 50 " | Glycerine, |
| 165 " | Water, | 80 " | Water, |
| 100 " | China clay paste 1:1, | 100 " | China clay paste 1:1, |
| 10 " | Caustic Soda $76\frac{1}{2}^{\circ}$ Tw., | 50 " | Caustic soda $76\frac{1}{2}^{\circ}$ Tw., |
| 20 " | Hydrosulphite NF conc. 1:1, | 40 " | Hydrosulphite NF conc. 1:1, |
| 670 " | Alkaline thickening (page 251). | 650 " | Alkaline thickening. |
| 1000 parts. | | 1000 parts. | |

| Grey. | | Black. | |
|-------------|---|-------------|---|
| 2,5 parts | Thiogene Grey BD extra strong, | 80 parts | Thiogene Black MD conc , |
| 50 " | Glycerine, | 50 " | Glycerine, |
| 137,5 " | Water, | 105 " | Water, |
| 100 " | China clay paste 1:1, | 75 " | China clay paste 1:1, |
| 50 " | Caustic soda $76\frac{1}{2}^{\circ}$ Tw., | 50 " | Caustic soda $76\frac{1}{2}^{\circ}$ Tw., |
| 10 " | Hydrosulphite NF conc. 1:1, | 40 " | Hydrosulphite NF conc. 1:1, |
| 650 " | Alkaline thickening. | 600 " | Alkaline thickening, |
| 1000 parts. | | 1000 parts. | |

In Direct printing, the best results are generally obtained with Sulphur colours when working with a strongly alkaline paste; for blacks it is necessary to use these strongly alkaline thickenings.

b) Weak Alkaline Printing Colours.

In order to avoid the difficulties which arise when working with strongly alkaline printing colours, the latter are prepared as follows (C. Wander's method): The Sulphur colours are not dissolved

in water but added direct to the thickening, when a more homogeneous mixture is obtained, which, moreover, prints more easily. The printing capacity is still further improved by the addition of Olive oil. Good results are obtained when working according to the following recipes:

Printing Colour.

| | |
|-------------------|--|
| 125 parts | Thiogene colour D brand. |
| 275 | „ Thickening A, |
| 250 | „ Hydrosulphite NF conc., |
| 200 | „ Caustic soda 72° Tw. are heated to 122° F., allowed to stand for 1/4 hour, cooled and |
| 150 | „ Potassium Sulphite 91° Tw. added. |
| <hr/> 1000 parts. | |

The colour is printed weaker according to requirements. For reducing the pastes, the undermentioned Thickening B is used.

The advantages of this method are that the outlines of the prints remain sharp in steaming and the back greys are not impaired.

Blue III.

| | |
|-------------------|---|
| 25 parts | Thiogene Cyanine OD conc., |
| 55 | „ Thickening A, |
| 50 | „ Hydrosulphite NF conc. 1:1, |
| 40 | „ Caustic soda 72° Tw., are allowed to stand for 1/4 of an hour at 122° F. then cooled, and |
| 30 | „ Potassium Sulphite 91° Tw., |
| 600 | „ Thickening B added. |
| <hr/> 1000 parts. | |

Thickening B.

| | |
|-------------------|----------------------------------|
| 450 parts | Tragacanth, |
| 150 | „ Burnt Starch, |
| 125 | „ Glycerine, |
| 60 | „ Caustic soda 71° Tw., |
| 38 | „ Potassium Sulphite 91° Tw., |
| 40 | „ Hydrosulphite NF conc. 1:1, |
| 60 | „ Olive oil, |
| 70 | „ China clay 1:1, |
| 7 | „ Water. |
| <hr/> 1000 parts. | |

Thickening A.

| | |
|-------------------|---------------------|
| 350 parts | Light burnt starch. |
| 150 | „ Water, |
| 500 | „ Glycerine. |
| <hr/> 1000 parts. | |

Violet.

| | |
|-------------------|---|
| 25 parts | Thiogene Rubine OD extra strong, |
| 155 | „ Water, |
| 50 | „ Caustic soda 76° Tw., |
| 100 | „ China clay paste 1:1, |
| 20 | „ Hydrosulphite conc. powder. |
| 650 | „ British gum thickening 1:1, are heated up to 122° F. |
| <hr/> 1000 parts. | |

The printed goods must be dried only lightly: they are then steamed in the Mather-Platt ager (free from air) for 3-6 minutes, according to the depth of shade, with powerful moist steam at 212-216° F. By preference two passages are given.

Thiogene Yellow, Green, Rubine and Violet must be soured after steaming. It is advisable to pass the other Thiogene colours after printing and before washing, through a warm bath (122° F.) containing 10 parts Sulphuric acid 168° Tw. and 2 parts Copper Sulphate per 1000 parts. By this means fuller shades are obtained and the bleeding of the colour into the white is obviated. The goods are then washed at full width in the washing machine and afterwards well soaped.

B. The Application of the Thiogene Colours in Discharge Printing.

On account of the reducing and alkaline action of the Thiogene printing colours, it is possible to use them for resist printing under Aniline Black and Diphenyl Black, and also in discharge printing on Turkey Red, Para Red and Dianil colours.

| Blue Discharge Colour for Para Red. | | Black Discharge Colour for Para Red. | |
|--|--------------------------------|---|------------------------------|
| | 40 parts Thiogene Blue BD | | 80 parts Thiogene Black MD |
| | conc., | | conc., |
| 50 | „ Glycerine, | 50 | „ Glycerine, |
| 50 | „ Caustic soda 76° Tw., | 50 | „ Caustic soda 76° Tw., |
| 100 | „ China clay paste 1:1, | 80 | „ China clay paste 1:1 |
| 270 | „ Thickening BRW (page 252) | | are heated until |
| 150 | „ Hydrosulphite NF | 20 | „ dissolved, and |
| | conc., | | Hydrosulphite conc. |
| | are heated to 122° | 250 | „ pdr., |
| | F., and | 150 | „ Thickening BRW, |
| 340 | „ Caustic soda 76° Tw. | | Hydrosulphite NF |
| | added cold. | | conc., |
| | | 320 | „ Caustic soda 76° Tw., |
| | | | added. |
| 1000 parts. | | 1000 parts. | |
| Blue Discharge Colour on Turkey Red | | Blue Discharge Colour on Alpha Naphtylamine Claret. | |
| | 40 parts Thiogene Blue BD | | 10 parts Thiogene Cyanine GD |
| | conc., | | conc., |
| 50 | „ Glycerine, | 50 | „ Glycerine, |
| 80 | „ China clay 1:1, | 50 | „ Caustic soda 76° Tw., |
| 50 | „ Caustic soda 76° Tw., | 100 | „ China clay 1:1, |
| 40 | „ Hydrosulphite NF | 50 | „ Water, |
| | conc., | 270 | „ Thickening BRW, |
| 50 | „ Water, | 150 | „ Hydrosulphite NF |
| 650 | „ Alkaline thickening are | | conc. are heated until |
| | heated to 122° F., then | | dissolved, cooled and |
| | cooled and | 270 | „ Caustic soda 76° Tw., |
| 40 | „ Silicate of Soda 66° | 50 | „ Anthraquinone paste |
| | Tw. | | added. |
| 1000 parts. | | 1000 parts. | |

When discharging Dianil colours it is advisable to impregnate the material before printing with a solution of Chlorate of Soda (5—10 parts per 1000 parts).

Discharge paste for Dianil colours.

| | |
|-------------------|---------------------------------|
| 25 parts | Thiogene Yellow GCD conc., |
| 50 „ | Glycerine, |
| 75 „ | Water, |
| 100 „ | China clay paste 1:1, |
| 50 „ | Caustic soda 76° Tw., |
| 580 „ | Alkaline thickening (page 252), |
| 120 „ | Hydrosulphite NF conc. 1:1. |
| <hr/> 1000 parts. | |

C. Dyeing and Padding with Thiogene Colours.

Full particulars respecting the dyeing of the Thiogene colours are given in the chapter on cotton dyeing, pages 122 etc.

The liquid brands of the Thiogene colours are especially suitable for padding.

By dyeing or padding with the Thiogene colours first and then topping with insoluble Naphtol Azo colours, the latter may be shaded in a most successful manner. Thus, for example, by first dyeing with Thiogene Blue, Thiogene Cyanine, Thiogene Green or Thiogene Black and afterwards with Para Red, a series of very fast claret and brown shades is obtained. By printing with Hydrosulphite NF conc. and subsequently steaming these combinations, very beautiful effects can be obtained.

D. Discharging Thiogene Colours.

This process is employed to imitate multi-coloured woven effects; for example, goods dyed with Thiogene Black may be discharged in one or more colours.

The dyed and washed material is soured with 3% Acetic acid, then printed with Chlorate discharge, steamed for about 5 minutes in the Mather-Platt at 212° F. and subsequently steamed in the steam box. The goods are then passed through a bath (122—140° F.) containing 5 parts Caustic Soda 76° Tw. per 1000 parts, and finally soaped. Coloured discharges are printed upon the previously white discharged material and again steamed. The recipe for the discharge colour is given on page 333.

E. Resisting the Thiogene Colours.

In practice, however, the discharge prints have found only a limited application, since this method is liable to injure the cotton fibre considerably, especially in the case of thin woven goods. Consequently attempts have been made to resist the Sulphur colours in a similar manner to that employed in the case of Indigo, which idea

is set forth in the German patent 130 628 (Cassella & Co.). The process first attained practical importance in Russia, when it was found that better results were obtained by padding the Sulphur colours instead of dyeing in the usual way. The resist process may also be combined with the Insoluble Azo colours, by first printing the naphtolated goods with the white and coloured resists and afterwards padding with Sulphur colours.

After printing, the goods are passed through the padding bath at 176° F. well squeezed, exposed to the air for about $\frac{1}{2}$ a minute, and steamed for a short time in the first two covered compartments of an open washing machine. They are then washed in the continuous machine, soured (1° Tw. Hydrochloric acid), again washed and soaped. The following are two practical recipes:

| a) White Resist. | b) Red next to White Resist. |
|-------------------------------------|-------------------------------------|
| 200 parts British gum powder, | (on Naphtol prepare.) |
| 300 „ Water. | 16 parts Azo Pink NA, |
| 200 „ China clay 1:1, | 60 „ Water, |
| 300 „ Chloride of Zinc. | 30 „ Hydrochloric 36° Tw., |
| 1000 parts. | 150 „ Ice Water, |
| Naphtol Prepare. | 26 „ Nitrite (290:1000) |
| 20 parts Beta Naphtol R, | are made up to, |
| 40 „ Caustic soda 76° Tw., | 300 parts and then stirred into, |
| 25 „ Para soap PN | 200 „ Tragacanth (60:1000), |
| 1000 parts. | 30 „ Sodium Acetate, |
| Padding Bath. | 300 „ Zinc Chloride, |
| 25 parts Colour, | 170 „ China clay (1:1) |
| 50 „ Caustic soda 76° Tw., | 1000 parts. |
| 70 „ Glucose | |
| and make up to. | |
| 1000 parts | |

5. VAT COLOURS.

Indigo MLB, MLB/T, MLB/R, MLB/RR, MLB/2B,
 MLB/4B, MLB/5B, MLB/6B
 Helindone Red 3B, B,
 Helindone Fast Scarlet R,
 Helindone Scarlet S,
 Helindone Orange R,
 Helindone Yellow 3GN,
 Helindone Brown G,
 Helindone Grey BB.

The method of vat dyeing has been already described in the chapter on cotton dyeing, pages 129 etc.

A. Indigo Discharge Printing.

The oxidising agents most suitable for discharging Indigo are Chromates, Chlorates (Bromates) and Alkaline Ferricyanides in combination with Caustic Alkalies. For reduction discharges Hydrosulphite NF conc. is used.

The vat dyed goods which are to be discharged, must be clean and free from stains; above all, lime stains and grease stains are to be avoided, since they counteract and resist the discharges.

1. Chromate Discharge.

By printing Chromates and subsequently passing the goods through a hot souring bath Chromic acid is liberated, which oxidises the Indigo to Isatin. This method of discharging Indigo is indispensable for multi-coloured Indigo styles, in which insoluble pigments such as Vermilion, Chrome Yellow, Guignet Green, Smalt Blue, lakes prepared from artificial colours etc. are printed together with Chromates and Albumen solution. The fixation of the colour lakes is brought about by the reaction of the acid on the Albumen, which coagulates on passing through a hot acid bath. By the action of Chromic acid on Cellulose however, Oxycellulose is formed, which always impairs the fibre. In order to obviate this somewhat, organic substances such as Glycerine, Alcohol, Lejogomme etc. are added to the hot acid bath, which mitigate the action of the Chromic acid to a certain extent. Oxalic acid seems to act in a similar manner; it is therefore almost always added to the acid bath. It regulates the discharging and counteracts the superfluous Chromic acid.

The Albumen is dissolved with the addition of Borax: Ammonia and Turpentine are added to the printing pastes, since they improve the consistency of the latter and prevent frothing. The amount of Chromate in the discharges is regulated according to the depth of the engraving, and the depth of the blue to be discharged. For very strong discharges Bichromate of Soda is used. As a rule, Soda or Ammonia is added to the Chromate discharges, and especially to the coloured discharges containing Albumen, in order to neutralise the Chromic acid. The Chromate discharge method may be combined with the Chlorate discharge process: for example, in multi-coloured discharge styles the white discharge can be produced with Chlorate and the coloured discharges with Chromate. In this case the passage through the "acid" bath is preceded by steaming in the Mather-Platt.

| Standard White Discharge I. | | Standard White Discharge II for very dark shades. | |
|--------------------------------|------------------------|---|-----------------------|
| 180 parts | Potassium Bichromate. | 250 parts | Sodium Bichromate, |
| 276 " | Hot water, neutralised | 130 " | Water, |
| 64 " | Soda calc., then | 70 " | Soda lye 76 1/2° Tw., |
| 280 " | Burnt starch, | 250 " | Burnt starch. |
| 200 " | Water added. | 1000 parts. | |
| 1000 parts. | | | |

Slightly heated before use.

Small additions of Albumen to the white discharges produce sharper outlines and prevent the colour from marking off. In this case it is advisable to steam the printed goods for 15--30 seconds in the Mather-Platt, before passing them through the acid bath. Indigo MLB/R and MLB/RR can be discharged by means of these stronger discharges.

Standard White Discharge III.

| | |
|----------------------------------|----------------------------------|
| 200—300 parts Sodium Bichromate, | } heated, cooled, then added: |
| 470—350 „ Water, | |
| 300 „ Burnt starch, | |
| 30—50 „ Blood Albumen 1:1. | |
| 1000 parts. | |

For coloured discharges the following may be used: Chrome Yellow, Vermilion, Olive, Turquoise Green, and the discharge lake colours, Pigment Chrome Green, Pigment Chrome Yellow L, Pigment Orange R, Pigment Lake Red and Lake Red P.

| | Discharge Yellow | Discharge Red | Discharge Green |
|--------------------------------|---------------------|------------------|--------------------|
| Chrome Yellow Lake | 400 | — | — |
| Lake Red | — | 400 | — |
| Vermilion | — | 135 | — |
| Olive Lake | — | — | 400 |
| Tragacanth (60:1000) | 200 | 150 | 200 |
| Albumen 1 1 | 200 | 170 | 250 |
| Ammonia | 60 | 35 | — |
| Olive Oil | 15 | — | 40 |
| Turpentine | 15 | — | — |
| Sodium Bichromate | 110 | 110 | 110 |

1000 parts.

The discharge colours must be finely ground and then strained.

After printing, the goods are dried and then passed in the roller cistern for about $\frac{1}{2}$ a minute through an acid bath at about 140° F.

Acid Bath.

| |
|-----------------------------------|
| 50 parts Sulphuric acid 168° Tw., |
| 50 „ Oxalic acid, |
| 1000 „ Water. |

An addition of Diamalt thickening, prepared according to the following recipe and containing principally Maltose, acts very favourably.

Diamalt Thickening.

- 20 gall. Water and
 100 lbs. Potato starch are heated, with constant stirring, to 131° F., then are added,
 2 „ Diastaphor, the paste well stirred for about 20 minutes, and the temperature raised to 149° F. The mixture is then cooled, after which are added,
 100 „ Potato starch, heated to 122° F., then again,
 4 „ Diastaphor are added, and the whole left to stand for an hour at 149° F., and finally heated to the boil.

The Starch-Sugar solution so obtained is a good substitute for Glucose, and contains 70—75% of Maltose, 10—20% of Maltose Dextrine, together with some unconverted starch.

Of this solution 5 parts per 1000 are added to the acid bath.

After souring, the goods must be well washed, in order to prevent the fibre from being impaired during the subsequent drying.

The Oxalic acid can be replaced by Potassium or Calcium Oxalates.

For illuminating Indigo discharged styles, direct dyeing cotton dyestuffs fast to acid, and Insoluble Azo colours can also be used. The latter are faster to washing and as bright as Albumen lakes. The Indigo dyed material is first grounded with Naphtol, and then printed with the Chromate discharges containing the diazo compounds necessary for the production of Azo colours. The dry goods are then passed through the acid and washed. This method is suitable for the Diazo compounds of Amido Azo Benzole, Paranitriline and Metanitriline.

| Naphtol Prepare. | Discharge Red Printing Colour A. |
|--------------------------|----------------------------------|
| 25 parts Beta Naphtol R. | |
| 50 „ Soda lye 36° Tw., | 270 parts Tragacanth (60:1000), |
| 25 „ Para Soap PN | 180 „ Sodium Bichromate. |
| made up to | 550 „ Azophor Red solution. |
| 1000 parts. | 1000 parts. |

Azophor Red Solution

| |
|--|
| { 224 parts Azophor Red PN are dissolved in, |
| { 600 „ Water. After filtering, add slowly |
| 100 „ Soda lye 36° Tw. with Water. |
| and make up to. |
| 1000 parts. |

2. Chlorate Discharge.

The Chlorate discharge is a steam discharge which, when properly carried out, does not injure the fibre and is therefore especially suitable for large surface patterns. The Chlorate discharge has been described on page 340.

Chromate and Chlorate discharges can be resisted on Indigo by certain substances which act as reducing agents, such as Sulphites, Sulphocyanides or Acetates.

Resist S under Chromate and Chlorate Discharges.

| |
|-----------------------------------|
| 250 parts British gum powder, |
| 150 „ Water, |
| 500 „ Potassium Sulphite 90° Tw., |
| 100 „ Potassium Sulphocyanide. |
| 1000 parts. |

By adding Tannin solution to this resist and making it slightly alkaline, the action is considerably increased.

Coloured Chlorate Discharges.

The Chromate discharge cannot be used for producing red, pink and orange coloured discharges next to white on indigo, because the whites are not pure. Certain Insoluble Azo colours however, can be employed for producing coloured discharges next to white according to the Chlorate discharge. Such colours are Azo Pink NA and Azo Orange NA, whose diazo compounds resist the action of Chlorate. The well washed material is impregnated on the 2 roller padding machine with the undermentioned preparation NC, in such a way that it absorbs about 85% of its weight of the liquid. It is then dried in the hot flue or in the "ager" and finally printed with the coloured and white discharge. The goods are then steamed twice (4 minutes each time) at 212—218° F., and washed for about 10 minutes over the winch in a liquor containing 5 parts Silicate of Soda per 1000 parts, and heated to 140° F. Finally the goods are rinsed.

| Preparation NC. | White NC. |
|--------------------------|------------------------------------|
| 15 parts Beta Naphtol, | 720 parts Paste NC, |
| 30 „ Soda lye 36° Tw., | 140 „ Acetic acid starch trag- |
| 20 „ Para Soap PN, | acanth thickening (page |
| are made up with | 251), |
| hot water to | 140 „ Tartaric acid powder. |
| 500 „ | 1000 parts. |
| 10 „ Tartar Emetic, | |
| 13 „ Glycerine, | |
| 15 „ Soda lye 36° Tw , | Coloured Discharge NA. |
| 262 „ Cold water. | 775 parts Paste NC, |
| 1000 parts. | 32 „ Acetic acid starch trag- |
| | acanth thickening, |
| | 40 „ Tartaric acid powder, |
| | 133 „ Diazo solution 1:10, |
| | 20 „ Acetate of Soda. |
| | 1000 parts. |
| | |
| Diazo Solution 1:10 | Paste NC. |
| 100 parts Azo Pink NA or | 580 parts Acetic acid starch trag- |
| 100 „ Azo Orange NA, | acanth thickening, |
| 200 „ Water, | 387 „ Chlorate of Soda cryst., |
| 222 „ Hydrochloric acid | 33 „ Sodium Ferricyanide. |
| 30 1/2° Tw , | 1000 parts. |
| 300 „ Ice, | |
| 43 „ Nitrite, | |
| 185 „ Water. | |
| 1000 parts. | |

Reducing paste for White NC.

880 parts Acetic acid starch-tragacanth thickening,
387 „ Tartaric acid powder.

3. Prussiate Discharge.

This method is only applicable for light and medium Indigo blues. If this process is combined with insoluble Azo colours, very brilliant and fast coloured discharges are obtained on Indigo grounds. For this purpose the diazo compounds of Paranitraniline, Metanitraniline, Nitrotoluidine, Ortho-anisidine, Chloranisidine and Alpha Naphtylamine are suitable. The Indigo dyed material is padded with Naphtol, dried, and printed with the discharge colour; it is then passed through a cold discharging bath for 10 seconds, washed and dried.

| Naphtol Prepare. | Discharge Red P. |
|------------------------|---------------------------------|
| 25 parts Beta Naphtol, | 400 parts Paranitraniline diazo |
| 50 „ Soda lye 36° Tw., | 50 „ „ „ „ „ |
| 25 „ Para Soap PN. | 400 „ Wheat starch traga- |
| 1000 parts. | canth thickening (page |
| | 251), |
| | 160 „ Red Prussiate of Pot- |
| | ash finely powdered, |
| | 40 „ Acetate of Soda cryst. |
| | 1000 parts. |

Discharging Bath.

100 parts Soda lye 21 $\frac{1}{2}$ ° Tw.,
1 „ Solvay Soda.

4. Reduction Discharges.

The problem of how to discharge Indigo, as well as other vat colours, by means of reducing agents, so as to produce white and coloured discharges, has been attacked very frequently. Very good results are obtained by working according to one of our patented processes, in which Hydrosulphite and Anthraquinone are employed.

By printing Hydrosulphite NF conc. and Anthraquinone, then steaming and passing through boiling Milk of Lime, Indigo dyed goods may be discharged white without impairing the fibre. This process offers great advantages over the older processes, for it is well known that the fibre is always more or less impaired by them.

Discharge white for Dark Indigo.

| |
|-----------------------------------|
| 125 parts Hydrosulphite NF conc., |
| 125 „ Water, |
| 650 „ British gum thickening 1:1, |
| 40 „ Anthraquinone paste, |
| 20 „ Acetine, |
| 40 „ Water. |
| 1000 parts. |

After printing, the material is steamed for 3 minutes at 214° F., passed for $\frac{3}{4}$ of a minute through boiling Milk of Lime (10 parts slaked Lime per 1000 parts) and washed.

It is advisable to finish the printed and steamed goods as soon as possible.

B. Indigo Resist Styles.

The so-called pulp resists contain, besides thickening (consisting generally of Gum, Flour or Burnt starch), mechanically acting substances such as Lead Sulphate, Barium Sulphate, Pipe Clay, Fats, and oxidising agents such as Copper Salts, Lead Salts etc., by means of which an almost impenetrable protecting film is precipitated on the surface of the resist. The alkaline condition of the dye bath effects also the precipitation of the soluble metal salts present in the resist.

Yellow and orange resists are produced by means of Lead Salts and subsequent chroming, or by means of Aurophenine or Toluylene Orange; red resists are obtained by combining Para Red with the white resist. When printed on a light Indigo ground white resists yield a light blue, and coloured resists produce mixed shades. An addition of a Chromate, e. g. Zinc Chromate to the resists, discharges the light blue ground.

The preparation of the goods consists in de-Sizing and boiling off, without subsequent chemicking. The dried material is then prepared with a solution of 15 parts Wheat starch and 15 parts of Glue per 1000 parts. In order to facilitate the wetting of the goods, a small addition of Turkey Red oil to the starch solution may be made. An addition of 1-2 parts Nitrate of Ammonia, Copper Sulphate or Manganese Sulphate tends to produce darker shades. A preparatory treatment on the calender acts beneficially upon the resists.

The Indigo resists are printed upon previously starched goods either by hand or with the perrotine, or also by means of a roller printing machine.

In order to harden the pulps the goods are hung for a long time in a warm place.

Usually the material is dyed in the Zinc Lime vat on sinking frames. According to a more recent process, the pulp resist styles may be dyed on the continuous machine; the resists are subjected to a hardening or protective treatment by padding with solutions of Soda, Caustic soda etc. By combining this preparatory treatment with a process of padding with suitable dyestuffs, such as the Thiogenic colours, a material saving of Indigo can also be effected. The hardening of the resists may also be effected by steaming. Before dyeing, the goods are entered into a vat containing only Lime water, in order to swell and harden the pulp. The wetting vat contains per 1000 gallons, 60 lbs. Caustic lime and 20 lbs. Calcined soda, and is daily "freshened up" with 4-6 lbs. Caustic lime, to which now and then 4-10 lbs. of Calcined soda are added.

Vat Liquid.

50 lbs. Indigo MLB paste 20% or 10 lbs. of Indigo MLB powder are well mixed with

6 ,, Zinc dust and

4 gall. Water 122° F., then are added

20 lbs. Burnt lime slaked with

8-20 gall. Water.

The temperature of the standard vat must be about 104° F.; it is stirred several times, allowed to rest for 4-6 hours, and then

poured into the dye vat which has previously been made up with Zinc dust and Lime, viz:

200 gallons Water.

10 ozs. Zinc dust made into a paste with water.

2 lbs. Caustic lime slaked with water.

After dyeing, the goods are soured at full width. If the printing has been carried out on a white ground, the goods are soured for 2 minutes at 104° F. with Sulphuric acid (30 parts Sulphuric acid 163° Tw. per 1000); if printed on a light blue ground, and in all cases where the resist contains Zinc Chromate, the goods are soured for 2 minutes at 120° F. in a bath containing 50 parts Sulphuric acid 148° Tw. and 20 parts Oxalic acid per 1000 parts.

The goods are then washed at full width. In the case of yellow and orange resists, the material is passed, after souring and washing, for 2 minutes through a cold bath containing 2 parts Caustic lime per 1000 parts, then washed and treated for 5 minutes at 104° F. with 5 parts Potassium Bichromate and 2.5 parts Hydrochloric acid 33° Tw. per 1000 parts, and afterwards again well washed. If the yellow is to be converted into orange, the goods are passed for $\frac{3}{4}$ of a minute through a clear boiling solution of 10 parts Potassium Bichromate and 40 parts Quick-lime per 1000 parts, and then well washed. The Sulphuric acid used for souring must be perfectly free from Hydrochloric acid, as even small quantities thereof will impair and dissolve the resists containing lead.

Standard Resist I.

253 parts China clay are made into a paste with

275 „ Water, then are added

225 „ Gum solution 1:1.

80 „ Finely powdered Verdigris and

80 „ Powdered Copper Sulphate.

The mixture is left to stand for 12–24 hours, being frequently stirred; then are added

35 „ Tallow: it is then boiled for 1–2 hours, the evaporated water being replenished, then are added

50 „ Powdered Alum, the mixture ground in a stone or porcelain grinding mill for 2–8 days, and finally passed through a fine sieve.

1000 parts.

Standard Resist II.

60 parts China clay are mixed with

235 „ Sulphate of Lead 50% paste,

250 „ Water and

175 „ Gum solution, then are added

70 „ Verdigris, finely powdered,

70 „ Copper Sulphate, finely powdered,

35 „ Acetate of Lead.

35 „ Nitrate of Lead, after being left to soak for 12–24 hours, there are added

30 „ Tallow, then boiled for 1–2 hours, the evaporated water being replenished, then are added

40 „ Alum, and the whole well ground and strained, like the Standard Resist I.

1000 parts.

White Pulp F.

| | |
|--------------------------------|--|
| 100 parts Gum powder, | } boiled ground and strained. |
| 170 „ Water, | |
| 330 „ Sulphate of Lead powder, | |
| 180 „ Sulphate of Zinc, | |
| 220 „ Nitrate of Lead, | |
| <u>1000 parts</u> | |

Standard Resist II and White Pulp F may be used as yellow or orange resists, if the goods are subsequently chromed. By themselves they give a very sharp white resist. By means of chroming or orangeing a green or olive is obtained on a light blue ground. In order to obtain very bright orange resists, 5—10 parts Dianil Red R or 4B are to be added to the standard resist.

Discharge Resist III

| |
|------------------------------|
| 850 parts Standard Resist I, |
| 150 „ Chromate of Zinc. |
| <u>1000 parts.</u> |

Discharge Resist III serves as Discharge White Resist on a light blue ground for combinations of white light-blue resist, white green, white-yellow, white-olive.

The goods are soured in a mixture of Sulphuric and Oxalic acid, as above mentioned.

Discharge Resist IV.

| |
|-------------------------------|
| 850 parts Standard Resist II, |
| 150 „ Chromate of Zinc. |
| <u>1000 parts.</u> |

Discharge Resist IV is only used on a light blue ground, for combinations of white-green, yellow or white-olive-orange.

Discharge Resist V.

| |
|---------------------------------|
| 40 parts Aurophenine O, |
| 110 „ Thin Gum solution, |
| 700 „ Standard Resist I, |
| are boiled, and then added cold |
| 150 „ Chromate of Zinc. |
| <u>1000 parts.</u> |

Discharge Resist V is used on a white or light blue ground when a yellow is desired next to the orange. If Toluylene Orange R is added instead of Aurophenine O, an orange can be obtained next to the yellow: in that case, however, no orangeing is required.

By combining Insoluble Azo colours (Para Red) with the Indigo resists, bright and fast red resist styles upon Indigo grounds can be obtained. For their production Azophor Red PN, distinguished for its great stability, is to be especially recommended. If, in the recipe given below, Azophor Red is replaced by Azophor Orange MN, bright orange resist styles are obtained. Azophor Pink A in concentrated colours, even on ordinary Naphtol prepare which does not contain any Para Soap PN, yields a bright red.

The previously starched material is padded with hot Naphtol prepare, dried in the hot-flue or on the drying cylinders (the first two drums of which are covered with calico), then printed with the red resist, dyed in the Indigo vat, quickly washed without having been dried, and finally soured. The souring is effected at 104° F. in a bath containing 5 parts Hydrochloric acid 36° Tw. per 1000 parts for 5 minutes.

Naphtol Prepare.

25 parts Beta Naphtol R,
50 „ Soda lye 36° Tw.,
20 „ Para soap PN,
50 „ Tragacanth (60:1000)
make up to

1000 parts.

The above process can be considerably simplified by combining the previous starching operation with the Naphtol prepare.

Initial Prepare I.

175—200 parts Potato starch } are heated to 149° F., and brought
10000 „ Water } to the boil after 10 minutes. After
5 „ Diastaphor } cooling to 122—140° F. are added
500 „ Tragacanth (60:1000),
100 „ Para soap PN,
250 „ Soda lye 36° Tw.,
250 „ Beta Naphtol. Then is added the mixture of
30 „ Tartar Emetic,
15 „ Glycerine,
250 „ Soda lye 36° Tw.

Another advantageous prepare is the following:

Initial Prepare II.

150 parts Potato starch boiled with
5000 „ Water, cooled, then added lukewarm the solution of
250 „ Beta Naphtol R,
250 „ Soda lye 76° Tw.,
150 „ Monopole Soap,
4290 „ Water,
60 „ Potassium sulphite 90° Tw.

Red Resist.

{ 80 parts Azophor Red PN
made into paste with
{ 40 „ Water, and added to
480 „ Standard White AZ.
40 „ Sodium Acetate
crystals.
1000 parts.

The Orange resist is prepared, similarly to the Red resist, substituting Azophor Orange MN for Azophor Red PN.

Standard White AZ.

(Must be free from Copper salts.)
200 parts Senegal gum 1:1,
70 „ Water,
220 „ Nitrate of Lead well heated until dissolved; then are added
330 „ Sulphate of Lead powder,
180 „ Sulphate of Zinc powder heated and made up to

1000 parts.

The Standard White must be well ground before the Azophor Red solution and the Sodium Acetate are added. The coloured printing paste must be kept cool and never be heated. It is comparatively very stable.

Zinc resists under Helindone colours.

Zinc resist.

| | |
|-------------|----------------------|
| 400 parts | Gum Solution 1:2, |
| 200 " | China Clay 1:1. |
| 300 " | Zinc Chloride, |
| 50 " | Anthraquinone paste, |
| 50 " | Water, |
| | Make up to |
| 1000 parts. | |

Padding Solution.

| | |
|---|-----------------------------|
| For all Helindone colours with the exception of Helindone Yellow 3GN. | |
| 10—20 parts | Dyestuff, |
| 600 " | Hot Water, |
| 300 " | Stock Solution, |
| 6 " | Hydrosulphite NF conc. 1:1, |
| | Make up to |

1000 parts.

Stock Solution.

| | |
|-------------|----------------------------------|
| 2000 parts | Hot Water, |
| 200 " | Potash, |
| 100 " | Alizarine Oil, |
| 150 " | Soda Lye 76 $\frac{1}{2}$ ° Tw., |
| 5 " | Anthraquinone paste, |
| 120 " | Hydrosulphite conc. powder, |
| | Make up to |
| 3000 parts. | |

Padding Solution for Helindone Yellow.

| | |
|----------|----------------------------------|
| 10 parts | Helindone Yellow 3GN paste, |
| 200 " | Hot Water, |
| 40 " | Soda Lye 76 $\frac{1}{2}$ ° Tw., |
| 1 " | Anthraquinone paste, |
| 8 " | Hydrosulphite conc. powder, |
| 12 " | Hydrosulphite NF conc. 1:1, |
| | Make up to |

1000 parts.

The goods are printed with the resist, dried, padded cold with Helindone Colours, steamed for 5 minutes in the Mather-Platt and passed through Hydrochloric Acid 10:1000 then washed well and soaped at the boil.

C. Indigo Mercerised Styles.

It is a well known fact that mercersation intensifies to an extraordinary degree the affinity of cotton for Indigo White or Indigo. This experience has been diversely utilised in vat dyeing; the mercersation of cotton has a decisive influence upon the success and the fastness of Indigo printing.

The fact that Caustic alkalies deepen the Indigo shades is especially utilised for two styles

1. In order to produce solid shades with lighter backs, Soda lye of 53—64° Tw is printed on to the one side of the material by means of finely engraved pin rollers, and subsequently the pieces dyed in the Indigo vat (D.R.P. No. 107910).

2. In order to obtain darker designs on a light ground, the material is printed with thickened Soda lye 53—64° Tw. by means of finely engraved rollers, and subsequently dyed in the Indigo vat.

In both cases the Soda lye may be replaced by an alkaline Indigo printing colour (after the two methods of Indigo printing described further on) and the goods, after steaming, are then dyed immediately, without being washed. In this manner a considerable difference in depth between the printed and ground shades is obtained (German patent No. 163276).

The process of mercerisation is not only used for the production of discharged, but also of resist styles. For, if by means of finely ground Indigo Soda lye is printed on white goods which have been mercerised, it is possible to dye the so-prepared material not only in the immersion vat, but by observing great precautions and under certain circumstances, also in the continuous vat without impairing the hardened resist colours by the action of the Soda lye.

The dyeing of resist styles in the continuous vat offers great advantages, effecting a saving in wages and an increased production. On the other hand, the process of mercerisation has this drawback, that a more lengthy dyeing operation renders the vat liquid too alkaline, and thus partly impairs the stability and efficiency of the resists and partly deteriorates the condition of the vat.

According to the German patent No. 144286 the resists can also be hardened by Alkaline Carbonates e.g. by Potash. This method, moreover, makes it possible to combine Sulphur colours with Indigo, in which case the former are padded as a bottom.

According to the method proposed by G. Taghani (German patent No. T 8846 IV/8n) a perfect protection of the printed resists when dyeing the pieces in the continuous vat is obtained by covering them with a protecting layer of thickening ingredients which, if need be, may be mixed with Sulphur colours. The application of this neutral or slightly alkaline protecting layer has the advantage that, on the one hand, the vat is not injured, and on the other hand, the resists retain their acid character and, consequently, their resisting power, better than when employing a strongly alkaline cover.

D. Indigo Steam Printing.

The most important methods for fixing Indigo in steam printing are:

1. The so-called Glucose Printing method by Schlieper and Baum.
2. The alkaline Indigo Printing method with Hydrosulphite NF conc. Hoechst. (German patent No. 73878).

Both methods are characterised by the employment of very strongly alkaline colours which, by mercerising the cotton fibre (its shrinking must be avoided) cause the Indigo to become firmly united with the fibre. It is well known that the Indigo fixed by this method is distinguished for very great fastness to washing, soap and rubbing, in comparison with the Indigo fixed by dyeing.

1. Glucose Printing.

The material is prepared with Glucose, dried, and printed with a strongly alkaline Indigo colour thickened with British gum or Starch. Only little pressure is used in printing, so that an even layer is formed over the prepare. The goods are then dried quickly and steamed for 45 seconds in a special steaming apparatus.

If the reduction has succeeded well, the material, when coming out, must have a brownish-olive, but not a pure yellow nor a greenish colour. After leaving the steam box the goods are well cooled, in order to prevent any destruction of Indigo; they are then washed, soured and soaped.

The goods are washed and soured in the open in running water, whereby the Indigo White is converted into Indigo Blue by oxidation. They are then finally washed in a rope washing machine and, if necessary, soaped and washed again.

Glucose Prepare.

13½—2¾ lbs. Glucose are dissolved and diluted with water to 1 gallon. The goods are padded with this solution and dried quickly.

Printing Paste:

| | Light | Medium | Dark |
|--------------------------------|------------|------------|------------|
| Alkaline thickening (Page 252) | 800 parts | 800 parts | 750 parts |
| Soda lye 36° Tw. | 175 „ | 125 „ | 100 „ |
| Indigo MLB paste 20% | 25 „ | 75 „ | 150 „ |
| | 1000 parts | 1000 parts | 1000 parts |

In order to obtain white and coloured resists under Alkaline Indigo prints, the goods after being prepared with Glucose, are printed with resists which contain, as a resisting agent, Flowers of Sulphur or Lactic acid in combination with acid salts (e. g. Sulphate of Alumina). Other metal salts, notably those used in the usual pulp resists, also Nitrate of Ammonia, produce the same effects. Coloured resists of great fastness and beauty under Indigo are obtained by the addition of the sodium compound of Beta Naphthol and a suitable fatty mordant (Para soap PN) to the glucose prepare, and of diazo solution (e. g. Azophor Red PN, Azophor Pink A, Azophor Orange MN) to the resists prepared with Lactic acid and Sulphate of Alumina.

Sulphur Resist S.

| | |
|-------------|---|
| { 240 parts | Flowers of Sulphur, are made into a paste with |
| { 240 „ | Gum solution 1:1, then is added the hot solution of |
| { 240 „ | Sulphate of Alumina |
| { 240 „ | Water, and finally |
| { 40 „ | Acetate of Soda crystals |
| 1000 parts. | |

2. Alkaline Indigo Printing with Hydrosulphite NF conc.

This process consists of the simultaneous employment of Indigo and Hydrosulphite NF conc. Hoechst, in the presence of strong Caustic soda in the printing colour. The printing colour is stable.

This method, compared with that of Schlieper and Baum offers the following advantages:

1. The preparation of the material is dispensed with.
2. The result is less dependent on the degree of moisture of the printed material and of the duration of steaming.

Turkey Red and Paranitraniline Red are easily discharged with the alkaline Indigo-hydrosulphite NF printing paste. If, however, the goods prepared with Beta Naphtol are printed with this paste, the Insoluble Azo colours, distinguished for their beauty and fastness, may be combined with Steam Indigo Blue.

The percentage of Caustic soda in the printing paste must be relatively high, in order to ensure the most perfect fixation of the Indigo dyestuff. Moreover, the concentration of the Soda lye used in preparing the printing colour is such that, although its action may cause mercerisation, which facilitates the fixation of the dyestuff, no permanent shrinking of the fibre can take place. In those cases where for certain reasons the strong alkalinity of the printing colour is to be avoided and where the total exhaustion of the Indigo is of little moment, the Caustic alkali can be omitted from the colour, whilst the quantity of the reducing agent is increased.

Experience has shown that the following conditions must be fulfilled if good reduction is to be obtained:

1 The printed goods must be dried evenly, but not too much in a slightly warmed drying chamber; they must not enter the steaming apparatus too dry.

2. The steaming operation must be carried out for 2—3 minutes at 212—216° F. in a suitable steaming apparatus which must be free from air and which must be heated with plenty of steam.

An ordinary Mather-Platt with some alterations will serve as a suitable steaming apparatus. The required minimum temperature of 212—216° F. is obtained by insulating the steam box (insulating material, air space, wood lining), reducing the slot for the entrance and exit of the goods to $\frac{1}{4}$ — $\frac{1}{8}$ inch in width and, if necessary, fitting the interior of the apparatus with a system of heating pipes.

The washing and finishing operations of the steamed goods are the same as for the Glucose process; care must be taken to remove all the Soda lye by washing the goods in plenty of running water. Squirting pipes are not suitable before the greater part of the Soda lye is removed, or whilst the Indigo White is still imperfectly oxidised, as the squirted water might partly wash off the Indigo (as Indigo White), which is not yet sufficiently fixed, and thus cause unevenness. The printing colours are prepared according to the following recipes:

Steam Indigo Blue 65.

| | | | |
|------|--------|--------------------------|---|
| 70 | parts | British gum powder | are boiled with |
| 240 | „ | Water, | cooled down, and added slowly whilst constantly stirring, to |
| 530 | „ | Soda lye 91° Tw. | |
| | | On the other hand, | |
| 21.5 | „ | Hydro-sulphite NF conc. | are dissolved in |
| 23.5 | „ | Water at 122—140° F. | The solution is cooled and then poured slowly into the above. Finally |
| 65 | „ | Indigo MLB paste 20% and | |
| 50 | „ | Water | are added. |
| 1000 | parts. | | |

Steam Indigo Blue 150.

- { 60 parts Hydrosulphite NF conc. Hoechst are dissolved in
 40 „ Hot water, then cooled down and, whilst stirring, added
 in several portions to
 650 „ Alkaline British gum thickening B or B II, (Alkaline
 thickening B, page 252) Then mixed with
 100 „ Soda lye 77° Tw., and, when cold,
 150 „ Indigo MLB paste 20% added.
 1000 parts.

Alkaline British Gum Thickening B II

- { 26 parts Wheat starch or Maize starch,
 54 „ British gum,
 120 „ Water, slowly mixed with
 10 „ Soda lye 91° Tw.,
 30 „ Water, allowed to stand over-night, then added in several
 portions:
 760 „ Soda lye 91° Tw., then heated to 140° F. cooled and
 strained.
 1000 parts.

The above Indigo colour can be used for discharging Turkey Red; for Para Red it is advisable to increase somewhat the quantity of the discharging ingredients. It is advisable to treat the goods to be discharged (Turkey Red or Para Red) with alkalies, Soda or still better, Soda, 1½ ozs. per gallon being used. The following is the composition of an Indigo Blue discharge on Para Red (2¼ ozs. Beta Naphthol per gallon):

Steam Indigo Blue P on Para Red.

- 115 parts Hydrosulphite NF conc. are dissolved in
 160 „ Hot water and
 25 „ British gum powder, then cooled down and added whilst
 cooling to
 550 „ Alkaline British gum thickening; then add
 150 „ Indigo MLB paste 20%.
 1000 parts.

Indigo MLB/R paste 20% and Indigo MLB/RR paste 20% require considerably less reducing agents; 40 parts Hydrosulphite NF conc. are quite sufficient for the reduction of 200 parts of each of these Indigo brands.

As already mentioned, neutral Indigo pastes may also be used where printing with very alkaline colours is to be avoided, and the complete exhaustion of the Indigo is not essential as e. g. for very light blotch designs.

| Neutral Indigo Printing Paste. | Reducing Paste for Neu- tral Indigo Printing. |
|---|---|
| <div> <div>75 parts Indigo MLB paste</div> <div>20% 600 „ British gum thick- ening 1:1, 100 „ Hydrosulphite NF conc, 225 „ Hot water,</div> </div> <div>1000 parts.</div> | <div> <div>50 parts Hydrosulphite NF conc., 350 „ Water, 600 „ British gum thick- ening 1:1</div> <div>1000 parts.</div> </div> |

Indigo Derivatives.

The derivatives of Indigo : Indigo MLB/T, MLB/R, MLB/RR, MLB/2B, MLB/4B, MLB/5B and MLB/6B are brighter in shade than Indigo MLB, and are very fast colours.

Indigo MLB/T requires somewhat more reducing agent than Indigo MLB; it is especially used in light shades, on account of its bright greenish-blue hue.

Indigo MLB R and MLB/RR are redder than Indigo MLB and require somewhat less Hydrosulphite (20 parts Hydrosulphite per 100 parts dyestuff).

Indigo MLB/2B, on the other hand, requires more reducing agent.

For light and medium shades Indigo MLB/4B is reduced in the printing colour, but for dark shades it is reduced separately. Indigo MLB/5B and MLB/6B are reduced in the printing colour. All three brands are best printed slightly alkaline, and for light shades the addition of Dissolving Salt B is to be recommended. The prints of Indigo MLB/4B, MLB/5B and MLB/6B must be soaped hot in order to completely develop the shade.

Printing Colours.

| Indigo MLB/T. | Indigo MLB/R or MLB/RR. |
|---|---|
| <div>30 parts Hydrosulphite NF conc are dissolved, in 220 „ Water cooled and stirred into 700 „ Alkaline thickening B. Then add 50 „ Indigo MLB/T paste 20%.</div> <div>1000 parts.</div> | <div>40 parts Hydrosulphite NF conc. are dissolved in 30 „ Warm water, cooled and stirred into 630 „ Alkaline thickening B, 100 „ Soda of 76° Tw. Then 200 „ Colour, paste 20% are added cold.</div> <div>1000 parts.</div> |

Indigo MLB/2B.

| | |
|-------------------|------------------------|
| 700 parts | Alkaline thickening B. |
| 150 " | Hydrosulphite NF |
| | conc. 1:1. |
| 150 " | Indigo MLB/2B paste |
| | 20%. |
| <hr/> 1000 parts. | |

After printing, the goods are steamed for 3 minutes in the Mather-Platt (free from air) and then washed.

Indigo MLB/4B.

| | |
|-------------------|--------------------------|
| 150 parts | Indigo MLB/4B paste |
| | 20%. |
| 50 " | Glycerine, |
| 50 " | Soda lye 76° Tw., |
| | are well mixed, and then |
| 650 " | Alkaline thickening, |
| 37.5 " | Hydrosulphite NF |
| | conc. dissolved in |
| 37.5 " | Water. |
| 25 " | China clay paste 1:1 |
| | added. |
| <hr/> 1000 parts. | |

Indigo MLB/4B.

| | |
|-------------------|------------------------|
| 100 parts | Indigo MLB/4B paste |
| | 20%. |
| 100 " | Glycerine, |
| 50 " | Soda lye 76° Tw., |
| 12.5 " | Hydrosulphite NF |
| | conc. dissolved in |
| 12.5 " | Water, |
| 200 " | British Gum 1:1, |
| | heat until reduced, |
| | then cool and add |
| | the following mixture: |
| 370 " | Wheat starch traga- |
| | cant thickening, |
| 22.5 " | Hydrosulphite NF |
| | conc. dissolved in |
| 22.5 " | Water, |
| 60 " | Potassium Sulphite |
| | 91° Tw., |
| 50 " | Olive oil. |
| <hr/> 1000 parts. | |

Indigo MLB/5B.

| | |
|-------------------|------------------------|
| 100 parts | Indigo MLB/5B paste |
| | 20%. |
| 100 " | Glycerine, |
| 75 " | Soda lye 76° Tw., |
| 50 " | Glucose, |
| 285 " | Water, |
| 250 " | British Gum pdr., |
| 30 " | Olive oil, |
| | Heated to 140° F. |
| | until reduced, then |
| | cooled and |
| 50 " | Hydrosulphite NF |
| | conc. 1:1 diss. in Gum |
| | solution, |
| 60 " | Potassium Sulphite 91° |
| | Tw. added |
| <hr/> 1000 parts. | |

Indigo MLB/5B.

| | |
|-------------------|-------------------------|
| 100 parts | Indigo MLB/5B paste |
| | 20%. |
| 100 " | Glycerine, |
| 275 " | Water, |
| 75 " | Soda lye 76° Tw., |
| 30 " | Hydrosulphite conc. |
| | pdr., |
| 30 " | Dissolving Salt B, |
| 250 " | British Gum powder, |
| | Heated to 140° F. |
| | until reduced; then are |
| | added cold |
| 30 " | Olive oil, |
| 50 " | Hydrosulphite NF |
| | conc. 1:1 dissolved in |
| | Gum solution and |
| 60 " | Potassium Sulphite 91° |
| | Tw. |
| <hr/> 1000 parts. | |

Indigo MLB/6B.

| | |
|-------------|--|
| 100 parts | Indigo MLB/6B paste 20% (Patent applied for). |
| 75 | „ Glycerine. |
| 50 | „ Soda lye 76° Tw., |
| 50 | „ Glucose, |
| 500 | „ British gum 1:1, |
| | Heated to 104° F. until reduced, then cooled and |
| 60 | „ Potassium Sulphite 91° Tw., |
| 50 | „ Olive oil, |
| 50 | „ Hydrosulphite NF conc. 1:1, |
| 65 | „ Water added. |
| 1000 parts. | |

Helindone Colours.

Helindone Red B, 3B, Helindone Fast Scarlet R, Helindone Scarlet S, Helindone Orange R, Helindone Brown G, 3GN, Helindone Yellow 3GN and Helindone Grey BB are vat colours, which are printed in a similar manner to the Indigo derivatives; they may be combined with each other and also with the Indigo derivatives. All the Helindone colours must be soaped hot after steaming and oxidising, in order to develop the shades.

Helindone Red 3B.

| | |
|-------------|---|
| 150 parts | Helindone Red 3B 20%, |
| 60 | „ Glycerine, |
| 50 | „ Hydrosulphite NF conc. 1:1, |
| 250 | „ Potassium Sulphite 91° Tw., |
| 100 | „ British Gum thickening 1:1, |
| | are heated until the whole shows a greenish appearance, |
| | after cooling, |
| 100 | „ Hydrosulphite NF conc. 1:1, |
| 50 | „ Olive oil, |
| 240 | „ British Gum thickening 1:1 are added; |
| 1000 parts. | |

Helindone Red B.

| | |
|-------------|--|
| 150 parts | Helindone Red B paste are mixed with |
| 100 | „ Glycerine, |
| 50 | „ Hydrosulphite NF conc. 1:1, |
| 250 | „ Potassium Sulphite 91° Tw., |
| 160 | „ British Gum powder, |
| 140 | „ Water. The whole is heated to 140° F. and when the |
| | reduction is completed, |
| 50 | „ Olive oil and |
| 100 | „ Hydrosulphite NF conc. 1:1 are added cold. |
| 1000 parts. | |

Helindone Fast Scarlet R.

| | | |
|---|-------|--|
| 400 | parts | Helindone Fast Scarlet R paste are mixed with |
| 100 | „ | Glycerine, |
| 80 | „ | Caustic soda 76° Tw., |
| 40 | „ | Hydrosulphite conc. powder, |
| 30 | „ | Dissolving Salt B, |
| 180 | „ | British Gum pdr. and |
| 40 | „ | Water. |
| The whole is heated to 140° F. and when the reduction is completed: | | |
| 30 | „ | Olive oil and |
| 50—100 | „ | Hydrosulphite NF conc. 1:1 in Gum solution 1:2 are added cold. |

1000 parts.

Helindone Scarlet S.

| | | |
|--|-------|--|
| 250 | parts | Helindone Scarlet S paste are mixed with |
| 80 | „ | Glycerine, |
| 65 | „ | Soda lye 76° Tw., |
| 33 | „ | Hydrosulphite conc. powder, |
| 25 | „ | Dissolving Salt B, |
| 242 | „ | Water and |
| 200 | „ | British gum powder. |
| The whole is heated to 140° F. and when the reduction is completed | | |
| 25 | „ | Olive oil, |
| 40 | „ | Hydrosulphite NF conc. and |
| 40 | „ | Gum solution 1:2 are added cold. |

1000 parts.

Helindone Orange R.

| | | |
|-----------------|-------|--|
| 200 | parts | Helindone Orange R paste pat., |
| 50 | „ | Glycerine, |
| 50 | „ | Soda lye 76° Tw., |
| 24 | „ | Hydrosulphite conc. powder, |
| 400 | „ | British gum 2:1, |
| 96 | „ | Water, are heated upon the water bath until properly reduced, then |
| 80 | „ | Hydrosulphite NF conc. 1:1, |
| 100 | „ | Potassium Bisulphite 90° Tw., |
| are added cold. | | |

1000 parts.

Helindone Yellow 3GN.

| | | |
|--|-------|--|
| 150 | parts | Helindone Yellow 3GN paste, |
| 100 | „ | Glycerine, |
| 60 | „ | Soda lye 76° Tw., |
| 30 | „ | Dissolving Salt B, |
| 30 | „ | Hydrosulphite conc. powder, |
| 150 | „ | Water and |
| 200 | „ | British gum powder. |
| The whole is heated to 140° F. and when the reduction is completed a pure blood red colour obtained: | | |
| 30 | „ | Olive oil, |
| 100 | „ | Hydrosulphite NF conc. 1:1 in Gum solution and |
| 150 | „ | Potassium Sulphite 91° Tw. |
| are added cold. | | |

1000 parts.

| Helindone Brown G. | | Helindone Grey BB. | |
|---|--|---|-----------------------------|
| 300 parts | Helindone Brown G paste are mixed with | 150 parts | Helindone Grey BB paste |
| 80 " | Glycerine, | 100 " | Glycerine, |
| 80 " | Soda lye 76° Tw., | 60 " | Soda lye 76° Tw., |
| 40 " | Hydrosulphite conc powder, | 30 " | Hydrosulphite conc. powder, |
| 60 " | Dissolving Salt B 1:1, | 60 " | Dissolving Salt B 1:1, |
| 200 " | British gum powder, | 200 " | British gum powder |
| 110 " | Water. | 270 " | Water. |
| The whole is heated to 140° F. and when the reduction is completed: | | Heat up to 140° F. until completely reduced and dissolved. When cold add, | |
| 30 " | Olive oil and | 30 " | Olive oil, |
| 100 " | Hydrosulphite NF conc. 1:1 are added cold. | 100 " | Hydrosulphite NF conc. 1:1 |
| 1000 parts. | | 1000 parts. | |
| Helindone Brown 3GN. | | | |
| 150 parts | Helindone Brown 3GN paste, | | |
| 700 " | Alkaline thickening, | | |
| 120 " | Hydrosulphite NF conc. 1:1, | | |
| 30 " | Soda lye 76° Tw. | | |
| 1000 parts. | | | |

After printing and drying, the goods are steamed twice (3 minutes each time) in the Mather-Platt, free from air. at 212° F.; they are then well washed, afterwards chromed, again washed and soaped hot for 10 minutes.

Reducing Paste.

| | |
|-------------|-------------------------|
| 500 parts | British gum powder, |
| 410 " | Water, |
| 50 " | Glycerine, |
| 15 " | Hydrosulphite NF conc., |
| 25 " | Olive oil. |
| 1000 parts. | |

VI.

COLOURS PRODUCED ON THE FIBRE BY A
PROCESS OF OXIDATION.

To this section belong Aniline Black and Diphenyl Black; the methods of application have already been described in the chapter on Cotton Dyeing, pages 153 and 158.

In Calico Printing the following methods are employed:

A. ANILINE BLACK.

1. Direct Printing.

Recipes for Aniline Black printing pastes:

| Aniline Oxidation Black I. | Aniline Oxidation Black II. |
|-------------------------------|--------------------------------|
| { 80 parts Wheat starch, | { 100 parts Wheat starch, |
| 65 „ Burnt starch, | 600 „ Water, boiled, then |
| 692 „ Water, boiled, then | added hot |
| added lukewarm | 35 „ Chlorate of Soda, |
| 35 „ Chlorate of Soda, | then added cold |
| 5 „ Aniline oil, | { 75 „ Aniline oil, |
| 93 „ Aniline salt. Then | 82.6 „ Hydrochloric acid |
| added before printing | 36° Tw., |
| 30 „ Copper Sulphide | 110 „ Water. Then added |
| paste 30°, | „ before use |
| 1000 parts. | 10 „ Vanadium solution |
| | 1:1000, |
| | 1012 parts. |

This Oxidation Black is printed either by itself or in combination with Mordant printing colours, developed after slight drying in the oxidation chamber (temperature 97° F. and 90° humidity) within about 18—24 hours, and then finished. Material which dyes well need not be chromed. Single colour Aniline Oxidation Black, which on account of its sharp outlines and also on account of cheapness, is still often printed, is always chromed in order to increase its fastness. The goods are chromed at about 122° F. with $\frac{3}{4}$ —1 oz. of Bichromate of Potassium per gallon, then washed and well soaped.

| Steam Aniline Black with Prussiate. | Steam Aniline Black with Chromate of Lead. |
|--|---|
| 500 parts Tragacanth(60:1000), | 60 parts Wheat starch, |
| 94 „ Aniline salt, | 545 „ Water, |
| 5 „ Aniline oil, | 120 „ Chrome Yellow 40% ₁₀ |
| { 25 „ Chlorate of Soda, | paste are mixed, boiled, |
| { 150 „ Water. | then added lukewarm |
| { 50 „ Yellow Prussiate, | 125 „ Ammonium Chloride, |
| { 176 „ Water, | 25 „ Chlorate of Soda, and |
| 1000 parts. | after cooling, |
| | 125 „ Aniline salt, |
| | 1000 parts. |

The development of Steam Aniline Black takes place by short steaming in the Mather-Platt. If printed in combination with other steam colours, a passage through Ammonia is given after the steaming in the Mather-Platt: the pieces may then be steamed for some time longer in the steam box with the object of fixing the second- and third-steam printing colours. The fastness of Steam Aniline Black is always greatly enhanced by subsequent chroming.

2. Resists for Aniline Black.

For this method a Prussiate-Steam Black is used (Prud'homme Black). White and coloured resists are printed on this preparation, and the goods passed through the Mather-Platt to develop the black, after which they are washed, chromed etc.

For resisting Aniline black, alkaline and reducing agents are used, chiefly Caustic and Alkaline carbonates: Silicate of Soda, Sulphites, Oxide of Zinc, Magnesium Carbonate, Sulphocyanides and stable Hydrosulphites (Hydrosulphite NF conc.).

The following colours are used for coloured resists:

1. Basic dyestuffs fixed either with Tannin or with the addition of Acetate of Zinc or Oxide of Zinc and Albumen.
2. Direct dyestuffs.
3. Colour lakes and pigments fixed with Albumen.
4. Sulphur colours printed with Alkali and Hydrosulphite.
5. Vat colours

With a view to the better fixing of the coloured discharges prepared with Basic dyestuffs, about $\frac{3}{4}$ —1 oz Tannin 1:1 per gallon are sometimes added to the padding liquor. A small addition of Hydrosulphite NF conc. (about $\frac{1}{2}$ — $\frac{3}{4}$ ozs. per gallon) acts very favourably, as it prevents the black from prematurely turning green.

The bleached or only boiled goods are padded on the padding machine, dried in the hotflue, printed with the resists, steamed for 2 minutes in the Mather-Platt, passed through a chrome bath ($\frac{3}{4}$ oz. Bichromate of Potash per gallon) for 1—1 $\frac{1}{2}$ minutes at 122° F., washed and dried. A Silicate of Soda bath may be used instead of the chrome bath, to which some Soda is usually added. Whilst the chrome bath is liable to yield a brownish black, the Silicate of Soda produces a bluish black.

Resists on padded Aniline Black.

White Resist I.

| | |
|-------------|-----------------------|
| 500 parts | Tragacanth (60:1000), |
| 150 " | Sodium Acetate, |
| 135 " | Sodium Bisulphite |
| | 67° Tw., |
| 215 " | Water, |
| 1000 parts. | |

White Resist III.

| | |
|-------------|-----------------------|
| 500 parts | Tragacanth (60:1000), |
| 150 " | Sodium Acetate |
| | crystals, |
| 25 " | Hydrosulphite NF |
| | conc., |
| 325 " | Water, |
| 1000 parts. | |

This white is very useful in case the goods impregnated with the Aniline padding black have already turned slightly greenish with lying.

White Resist II.

| | |
|------------|---------------------|
| 200 parts | British gum powder, |
| 500 " | Potassium Sulphite |
| | 91° Tw., |
| 200 " | Water, |
| 100 " | Soda lye 91° Tw., |
| 1000 parts | |

Is profitably employed for Aniline Black padding liquids containing Tannin.

White Resist IV.

| | |
|-------------|-----------------------|
| { 100 parts | Zinc White, |
| { 100 " | Water, |
| { 400 " | Tragacanth (60:1000), |
| { 150 " | Sodium Acetate |
| | crystals, |
| { 150 " | Water, |
| { 100 " | Albumen solution 1:1, |
| 1000 parts. | |

Coloured Resist I.

| | |
|-------------|---------------------------|
| 5—30 parts | Basic dyestuff, |
| 305—280 " | Water, |
| 50 " | Acetic acid 9° Tw., |
| 500 " | Acid starch thickening, |
| 140 " | Acetate of Zinc crystals, |
| 1000 parts. | |

For a better fixation some Albumen may be added to the Acetate of Zinc resist.

Coloured Resist II.

| | |
|-------------|-----------------------|
| 20 parts | Colour, |
| 180 " | Water, |
| 500 " | Tragacanth (60:1000), |
| 200 " | Acetate of Zinc |
| | crystals, |
| 100 " | Albumen 1:1, |
| 1000 parts. | |

Coloured Resist III.

| | |
|-------------|---------------|
| 20 parts | Colour, |
| 30 " | Glycerine, |
| 150 " | Water, |
| 800 " | Thickening A, |
| 1000 parts. | |

For the coloured resists II and III Basic and Direct dyeing dyestuffs are used.

| Thickening A. | Coloured Resist IV with Pigment Colours. |
|-----------------------------|---|
| 100 parts Oxide of Zinc, | 500 parts Pigment Colours (e.g. |
| 150 „ Magnesium Acetate | Pigment Red G), |
| 40° Tw., | 220 „ Tragacanth (60:1000), |
| 350 „ Tragacanth (60:1000), | 150 „ Albumen 1:1, |
| 100 „ Starch thickening, | 130 „ Sodium Acetate |
| 100 „ Albumen 1:1, | crystals. |
| 800 parts ground together. | 1000 parts. |

Coloured resists of very satisfactory fastness to washing and soaping can be obtained by printing colours containing Tannin, with the addition of Hydrosulphite NF conc.

Coloured Resist V.

| |
|--|
| 20 parts Basic dyestuff. |
| 25 „ Glycerine, |
| 10 „ Acetone, |
| 185 „ Water, |
| 350 „ Wheat starch tragacanth thickening (page 251), |
| 50 „ Carbolic acid, |
| 80 „ Tannin 1:1, |
| 75 „ Hydrosulphite NF conc., |
| 50 „ Water, |
| 5 „ Formaldehyde 40%, |
| 150 „ Sodium Acetate crystals. |
| 1000 parts. |

Resists under Aniline Black.

| White Resist IV. | White Resist V. |
|-----------------------------|-------------------------------|
| 70 parts Oxide of Zinc, | 265 parts British gum powder, |
| 294 „ Water, | 225 „ Senegal gum thickening |
| 75 „ British gum powder, | 1:1, |
| 165 „ Tragacanth (60:1000), | 150 „ Oxide of Zinc, |
| 66 „ Soda lye 36° Tw, | 100 „ Sodium Acetate |
| 35 „ Sulphocyanide of | crystals, |
| Ammonia 32° Tw., | 50 „ Magnesium Carbonate, |
| 295 „ Sodium Acetate | 50 „ Glycerine, |
| crystals. | 156 „ Water, |
| 1000 parts. | 4 „ Ultramarine. |
| | 1000 parts. |

| White Resist VI. | Coloured Resist VI. |
|------------------------------|-------------------------|
| 500 parts Starch thickening, | 20 parts Colour, |
| 300 „ Chalk, | 100 „ Water, |
| 60 „ Soda calc., | 760 „ Zinc paste, |
| 135 „ Water, | 40 „ Sodium Acetate |
| 5 „ Ultramarine. | crystals, |
| 1000 parts. | 80 „ Blood Albumen 1:1. |
| | 1000 parts. |

Zinc Paste.

| | | |
|-----|-------|---------------------|
| 105 | parts | Wheat Starch, |
| 715 | .. | Water, |
| 25 | .. | British Gum powder, |
| 155 | .. | Oxide of Zinc. |

1000 parts.

Applicable to all Basic dyes.

Coloured Resist VII.

| | | |
|-------------|-------|---------------------|
| 30 | parts | Colour, |
| 140 | .. | Water, |
| 80 | .. | Glycerine, |
| 200 | .. | Standard Colour I. |
| 400 | .. | Standard Colour II, |
| 20 | .. | Rapeseed Oil, |
| 130 | .. | Albumen 1:1. |
| 1000 parts. | | |

Standard Colour I.

| | | |
|-------------|-------|-----------------------|
| 820 | parts | Tragacanth (60:1000), |
| 180 | .. | Acetate of Zinc. |
| 1000 parts. | | |

Standard Colour II.

| | | |
|-----|-------|-----------------------|
| 400 | parts | Oxide of Zinc, |
| 200 | .. | Glycerine, |
| 200 | .. | Tragacanth (60:1000), |
| 200 | .. | Water. |

1000 parts.

Coloured Resist VIII.

| | | |
|-------------|-------|-----------------------------|
| 20 | parts | Colour, |
| 580 | .. | Water, |
| 20 | .. | Sodium Phosphate. |
| 200 | .. | British gum powder, |
| 30 | .. | Glycerine, |
| 150 | .. | Sodium Acetate crystals. |
| 1000 parts. | | |

Coloured Resist IX.

| | | |
|-----|-------|-----------------------------|
| 20 | parts | Colour, |
| 480 | .. | Water, |
| 200 | .. | British gum powder, |
| 30 | .. | Glycerine, |
| 150 | .. | Sodium Acetate crystals, |
| 120 | .. | Albumen 1:1. |

1000 parts.

The goods printed with the resists can be kept for several days in a dry place without spoiling. They are then padded on the back, dried on the drying-machine, steamed for 1—1½ minutes in the Mather-Platt, chromed in the usual manner, washed, soaped and dried.

Superposition Puce according to Henri Schmid.

The material dyed with Para Red is padded on the padding machine with a weak Steam Aniline Black padding liquid, carefully dried, and then printed with the discharges before the Aniline Black is developed.

Aniline Black Padding Bath.

| | | | | | |
|-----|-------|-----------------------|-----|-------|---------------------|
| 28 | parts | Aniline salt, | 10 | parts | Chlorate of Soda, |
| 2 | .. | Aniline oil, | 200 | .. | Water, |
| 200 | .. | Water, | 18 | .. | Yellow Prussiate of |
| 50 | .. | Tragacanth (60:1000), | | | Potash crystals. |
| | | | 200 | .. | Water. |

Mixed together and made up to 1000 parts with water.

| Discharge White HS. | Red Resist HS. |
|-----------------------------|---------------------------------|
| 225 parts Hydrosulphite NF | 450 parts Tragacanth (60:1000), |
| conc., | 400 „ Water, |
| 175 „ Water. | 150 „ Acetate of Soda |
| 450 „ Tragacanth (60:1000), | crystals. |
| 150 „ Acetate of Soda | 1000 parts. |
| crystals. | |
| 1000 parts. | |

The coloured discharges for Puce HS are prepared in the same manner as those with the addition of Phenol on Para Red, only 130 parts Sodium Acetate crystals per 1000 parts printing colour are added for resisting the Aniline Black.

B. DIPHENYL BLACK.

Diphenyl Black is produced from p-Amidodiphenylamine. It is ungreenable and does not injure the fibre, since only organic acids (Acetic and Lactic acids) are used in its preparation. Diphenyl Black, unlike Aniline Black, does not require to be chromed.

1. Direct Printing with Diphenyl Black.

The printing colours are prepared by dissolving Diphenyl Black Base I in Acetic and Lactic acid, and Diphenyl Black Oil DO in Acetic, Lactic and some Muratic acid, mixing these solutions with the thickening, and adding Aluminium Chloride 52° Tw. besides Sulphide of Copper, Vanadate of Ammonia or Cerium Chloride and Chlorate of Soda.

After printing, the pieces are slightly dried, and developed by steaming at 208—212° F. for 1—3 minutes in the Mather-Platt ager. As the fibre is not impaired by Diphenyl Black Base I, the black can also be used in combination with steam colours which have to be steamed for 1—1½ hours, as e. g. Basic and Mordant colours.

The Diphenyl Black printing colours give very sharp outlines and, contrary to Logwood Black, do not produce doctor streaks.

Diphenyl Black Base I is suitable for printing heavy blotch designs even upon very thin materials, for which Aniline Black cannot be used.

Diphenyl Black Oil DO, by means of which is obtained a bluer and cheaper black than with Diphenyl Black Base I, is especially applicable to blotches, and to large designs on raised cloths, flannelettes, velvets, half silks etc. For heavy designs on thin materials it must be used with caution, seeing that for dissolving the oil some Hydrochloric acid is necessary besides Acetic and Lactic acid. The Black is not absolutely ungreenable, owing to its containing Aniline Oil.

The recipes for Diphenyl Black are as follows:

Black Printing Colour
with Diphenyl Black
Base I

| | | | |
|---|------|-------|----------------------------------|
| { | 1100 | parts | Wheat starch, |
| { | 4500 | „ | Water, |
| { | 1080 | „ | Acetic acid 9° Tw , |
| { | 200 | „ | Olive oil, |
| | | | boiled for $\frac{1}{2}$ an hour |
| | | | then added warm, |
| | 300 | „ | Sodium Chlorate, |
| | | | then added cold the |
| | | | solution of |
| { | 350 | „ | Diphenyl Black Base |
| { | 1300 | „ | I in |
| { | 450 | „ | Acetic acid 9° Tw., |
| | | | Lactic acid 50%, |
| | | | Before use are added, |
| | 180 | „ | Aluminium Chloride |
| | | | 52° Tw , |
| { | 100 | „ | Copper Sulphide |
| { | 300 | „ | paste 30%, |
| { | 140 | „ | Water, |
| | | | Cerium Chloride |
| | | | 85° Tw. |

10000 parts

Black Printing Colour
with Diphenyl Black
Oil DO.

| | | | |
|---|------|-------|---------------------------------|
| { | 1100 | parts | Wheat starch, |
| { | 5315 | „ | Water, |
| { | 1125 | „ | Acetic acid 9° Tw., |
| { | 200 | „ | Olive oil boiled |
| | | | for $\frac{1}{2}$ an hour, then |
| | | | added warm, |
| | 250 | „ | Sodium Chlorate, |
| | | | then added cold the |
| | | | solution of |
| { | 500 | „ | Diphenyl Black Oil |
| { | 225 | „ | DO in |
| { | 123 | „ | Lactic acid 50%, |
| | | | Muriatic acid 20° |
| | | | Tw., |
| | 67 | „ | Water, |
| | | | Before use are added, |
| { | 200 | „ | Copper Sulphide |
| { | 630 | „ | paste 30%, |
| { | 215 | „ | Water, |
| | | | Aluminium Chloride |
| | | | 52° Tw. |

10000 parts.

Diphenyl Black can also be used along with the Insoluble Azo colours on a naphthol prepare.

For to this method the following recipe is used:

| | | | |
|---|-----|-------|------------------------------------|
| { | 45 | parts | Diphenyl Black Oil DO, |
| { | 50 | „ | Acetic acid 9° Tw , |
| { | 50 | „ | Lactic acid 50%, |
| { | 14 | „ | Muriatic acid 35° Tw., |
| | 612 | „ | Acid starch thickening (page 251), |
| | 45 | „ | Aniline Salt, |
| { | 35 | „ | Sodium Chlorate, |
| { | 90 | „ | Water, |
| { | 15 | „ | Sulphide of Copper paste 30%, |
| { | 15 | „ | Water, |
| { | 19 | „ | Aluminium Chloride 53° Tw., |
| | | | Before use add |
| | 10 | „ | Vanadium solution (1:1000). |

1000 parts.

A newer method of producing the Black-Red styles (for which a patent has been applied for) is the following:

The bleached material is treated with the Naphtol prepare containing some Tartar Emetic, dried in the hot flue, printed with Black DAP, steamed for 1 minute and then padded with diazotised Paranitraniline solution. The goods are then soaped and washed.

| Preparation 25 N. | Black DAP. |
|---------------------------------|---------------------------------|
| 25 parts Beta Naphtol R, | 500 parts Tragacanth (60:1000). |
| 25 „ Soda lye 76° Tw., | 100 „ China clay 1:1. |
| 20 „ Para Soap PN, | 57 „ Aniline salt, |
| 3 „ Tartar Emetic, | 16 „ Potash Permanganate 1. |
| 5 „ Glycerine | 5 „ Nitric acid 1:1, |
| 1000 parts. | 12 „ Aniline oil, |
| | 50 „ Acetic acid 9° Tw., |
| Developing Bath. | 20 „ Aluminium Chloride |
| 14 parts Diazo-Paranitraniline, | 52° Tw., |
| per 1000. | { 30 „ Chlorate of Soda, |
| | { 70 „ Water, |
| | 20 „ Copper Sulphide paste |
| | 30%, |
| | 105 „ Water, |
| | 15 „ Vanadium solution |
| | 1:1000). |
| | 1000 parts. |

2. Padding with Diphenyl Black.

The goods are padded on the padding machine, and then either dried on hot cylinders, which develop the black, or still better, passed through the hotflue and steamed in the Mather-Platt. The latter is preferable, inasmuch as it gives a purer black.

For thin materials Diphenyl Black Base I only must be used; for heavy materials, however, Diphenyl Black Oil is more suitable, as it gives a fuller and bluer black. After the goods are dried and steamed, they are washed and soaped hot. The recipes for the padding baths are the same as given in the chapter on cotton dyeing, pages 156 and 157.

3. Resist styles, produced with Diphenyl Black.

Diphenyl Black can be resisted by means of alkaline and reducing agents. These are: Caustic Alkalies, Carbonates, Acetates and Sulphites of Alkalies and Alkaline Earths, Zinc Oxide, Zinc Acetate etc. An addition of Hydrosulphite NF conc. also produces a favourable effect.

Resist T.

| | |
|-----|--|
| { | 110 parts Water, |
| 22 | „ Soda calc., |
| { | 110 „ Bisulphite 66° Tw., |
| | boiled, and the Carbon-dioxide driven off, |
| { | 300 „ Burnt Starch, |
| { | 150 „ Water, |
| 132 | „ Gum 1:1, |
| 66 | „ Acetate of Soda, |
| 110 | „ Sodium Thiosulphate. |
| | 1000 parts. |

also applicable under Chlorate discharges.

White Resist K.S.

| | |
|-------------------|-----------------------------|
| 250 parts | British gum powder, |
| 750 „ | Potassium Sulphite 91° Tw., |
| <hr/> 1000 parts. | |

VII.

NITROSO BLUE.

The most important blue of this group, Resorcine Blue MR, is produced on the fibre by the condensation of p-Nitrosodimethylaniline (Nitroso Base M 50%) and Resorcine. Nitroso Blue is used in direct printing and especially for white and coloured resist styles.

Nitroso Blue Printing paste on White Goods.

| | | |
|-------------------|-------|---|
| 600 | parts | Acid Starch thickening (page 251). |
| 20 | „ | Glycerine. |
| 26 | „ | Nitroso Base M 50% paste, mixed with |
| 20.3 | „ | Water. |
| 8.7 | „ | Muriatic acid 36° Tw. then added, |
| 20 | „ | Resorcine dissolved in |
| 147 | „ | Water, and stirred into the Acid starch thickening. |
| Then are added | | |
| 6 | „ | Oxalic acid dissolved in |
| 52 | „ | Water, |
| 60 | „ | Acetic acid tannin solution 1:1. |
| 40 | „ | Sodium Phosphate 1:5 added before use, |
| <hr/> 1000 parts. | | |

After printing, the goods are slightly dried, then gently steamed for 2—3 minutes in the Mather-Platt, passed through Tartar Emetic, washed and soaped.

Nitroso-Blue Printing paste as a Tannin Resist
on Naphtol Prepare.

| | | |
|-------------------|-------|-----------------------------------|
| 500 | parts | Acid starch (page 251), |
| 8 | „ | Nitroso Base M 50%, |
| 2.25 | „ | Hydrochloric acid 32° Tw., |
| 20 | „ | Glycerine, |
| 50 | „ | Water, |
| 4 | „ | Dioxynaphtaline 2.7 (Oxynaphtol), |
| 100 | „ | Water, |
| 7.5 | „ | Marine Blue BL, |
| 7.5 | „ | Violet Crystals O, |
| 12.5 | „ | Water, |
| 75 | „ | Acetic acid 9° Tw., |
| 100 | „ | Tartaric acid 1:1, |
| 150 | „ | Acetic acid tannin solution 1:1, |
| <hr/> 1000 parts. | | |

Resorcine Blue Padding Styles.

The goods are padded, dried in the hotflue and subsequently printed with the resists; they are then gently steamed for 2-3 minutes in the Mather-Platt, passed at full width through Tartar Emetic, washed and quickly soaped, after which they are dried. The material which has been impregnated with Nitroso solution may also be dried on the cylinder, but care must be taken that the drying is carried out evenly and not too quickly. A suitable white resist may first be printed on the white goods.

Nitroso Blue Padding liquids.

a) with Resorcine.

| | | |
|---|-------------|---|
| { | 24 parts | Nitroso Base M 50% paste, |
| | 50 " | Lukewarm water. |
| { | 8 " | Muriatic acid 36° Tw. are well stirred; |
| | | then is added the solution of |
| | 16 " | Resorcine, |
| | 16 " | Water, then |
| | 40 " | Aqueous Tannin solution 1:1, |
| | 60 " | Oxalic acid 1:10, the mixture stirred into, |
| | 100 " | Tragacanth (60:1000), and diluted with water to |
| | 800 parts | and before use, |
| { | 8 " | Sodium Phosphate dissolved in |
| { | 200 " | Water are stirred into it. |
| | 1000 parts. | |

b) with Tannoxyphenol.

| | | |
|---|-------------|---|
| { | 24 parts | Nitroso Base M paste 50%, |
| | 500 " | Water, |
| { | 8 " | Muriatic acid 36° Tw. are well stirred, |
| | | then is added the hot solution of |
| { | 30 " | Tannoxyphenol R |
| { | 100 " | Boiling water |
| | 60 " | Oxalic acid 1:10 and diluted with cold water to |
| | 900 parts. | Before use are slowly stirred into the mixture, |
| | 8 " | Sodium Phosphate dissolved in |
| | 100 " | Cold water. |
| | 1000 parts. | |

On account of their beauty, fastness and cheapness, resist styles are especially employed for raised goods

Nitroso Blue can be resisted in white and colours by means of Stannous salts and Sulphites. It is of advantage to add a sufficient quantity of Soda lye to the Sulphite resist prepared with Potassium Sulphite, in order to destroy the tannin of the Nitroso colour completely in the subsequent steaming operation, so that the staining of the white places may be obviated. Resorcine may be topped with Shading Blue B, which can also be resisted by Potassium Sulphite.

For coloured resists. Good dyesuffs are employed which are stable to Sulphite or Tin salts.

White Resists.

| White Resist I. | White Resist II. |
|-------------------------------|-------------------------------|
| 300 parts British gum powder, | 240 parts British gum powder, |
| 700 „ Potassium Sulphite | 560 „ Potassium Sulphite |
| 91° Tw heated on the | 91° Tw., |
| water bath. | 120 „ Soda lye 91° Tw., |
| 1000 parts. | 80 „ Water. |
| | 1000 parts. |

Coloured Sulphite Resist.

| Coloured Sulphite Resist. | Antimony Thickening. |
|-----------------------------|-----------------------------|
| 30—50 parts Basic dyestuff, | 40 parts Wheat starch, |
| 320—300 „ Water, | 300 „ British gum powder, |
| 30 „ Glycerine, | 335 „ Water, |
| 500 „ Antimony thick- | 250 „ Tragacanth (60:1000), |
| ening, | 75 „ Antimonine. |
| 120 „ Potassium Sulphite | |
| 91° Tw. | 1000 parts. |
| 1000 parts. | |

Coloured Tin Salt Resist.

| |
|--|
| 25—50 parts Basic dyestuff, |
| 125 „ Acetic acid 9° Tw, |
| 500—475 „ Water, |
| 200 „ Tragacanth (60:1000). |
| 50 „ Tin salt crystals (fine quality), |
| 50 „ Acetate of Soda crystals, |
| 50 „ Acetine. |
| 1000 parts. |

The following colours are stable to Sulphite and also to Tin salts:

Methylene Yellow H, Auramine conc, Flavophosphine, Safranine, Rosazaine, Rosazaine Scarlet G extra, Methylene Blue, Malachite Green, Methylene Grey, Methylene Violet, Victoria Blue, Methyl Violet, Ethyl Blue and Methylene Helotropes.

| White I for printing on White Cloth. | White II for printing on White Cloth. |
|---|--|
| 220 parts British gum powder, | 280 parts Potassium Sulphite |
| 400 „ Water, | 91° Tw., |
| 60 „ Sodium Tartar Emetic, | 720 „ Thickening WC. |
| 170 „ Glue solution 1:2, | 1000 parts. |
| 110 „ Tin crystals, when | |
| cooled, | |
| 40 „ Sodium Acetate | |
| crystals added. | |
| 1000 parts. | |

| Thickening W.C. | | Glue Solution 1:2. | |
|-------------------|-----------------------|------------------------------|--|
| I | 110 parts China clay. | 333 parts Glue are soaked in | |
| | 110 „ Water, | 500 „ Water, then are added, | |
| II | 150 „ Wheat starch, | 167 „ Acetic acid 50%, and | |
| | 200 „ Water, | heated until completely | |
| III | 300 „ Commercial Gum | dissolved, and then | |
| | 1:3, | up with Glue, and | |
| I, II and III are | | acid to, | |
| mixed, boiled, | | 1000 parts. | |
| then | | | |
| IV | 20 „ Japan wax, | | |
| | 110 „ Petroleum, are | | |
| slowly added, | | | |
| 1000 parts. | | | |

VIII.

NITROSO BROWN AND NITROSO GREEN

(for padding styles).

When dissolved in Alkali and combined with suitable mordants and oxidising agents, certain aromatic Nitroso-Oxysubstances may be used for padding baths for the production of green, brown and olive steam colours.

Di-nitroso-resorcine, which forms the basis for these colours and is known under the trade name of Solid Green O, can also be produced advantageously by treating Resorcine with Nitrite solution; this product is then employed in the padding baths without further purification. Resorcine is dissolved in water containing Hydrochloric acid and some Ice added; the solution is then thickened with Tragacanth, and the calculated quantity of Nitrite solution slowly added while constantly stirring. After standing for a short time, the yellow reaction-product is stirred into Ammonia or Caustic soda thickened with Tragacanth, when a clear brown solution is obtained. When dyeing green, a solution of Red Prussiate of Potash is now added; for brown Ammoniacal Copper Oxide or Phenylenediamine is added. Chlorate of Soda is also added in each case in order to counteract the unfavourable reducing influence of the resists, and to facilitate the development of the colour in steaming. Soft water must be used for the padding baths.

The Nitroso colours can be shaded sufficiently fast without the employment of Tannin, with Janus Red B, Azo Phosphine GOD, Malachite Green, Brilliant Green, New Magenta O, and with such other Basic colours as can be resisted with Sulphite or Hydrochloric acid. Fatty mordants must be added when employing these resists; dyestuffs, in order to obtain clear and stable padding baths.

The padded and dried goods are printed with the resist printing pastes and steamed once or twice, for 5 minutes each time, in the Mather-Platt. Nitroso Brown, produced with Copper and coloured resists, are steamed for $\frac{3}{4}$ of an hour at $\frac{1}{4}$ atm. pressure

in order to completely develop and fix the shades. By employing certain aromatic Diamines it is possible to produce Nitroso Brown shades which, like Nitroso Green, can be developed by steaming for 5 minutes in the Mather-Platt.

The padding baths are stable, and the padded goods are not deleteriously affected if allowed to lie several days before steaming.

After steaming, the goods are washed and soaped. The fastness to light, washing, and soaping of the Nitroso colours is satisfactory.

Nitroso Brown and Nitroso Green, like Nitroso Blue, can be resisted in white and colours by means of reducing agents. Dianil colours, which are stable to Sulphite, are employed for coloured resists, e. g. Dianil Blue H&G, Toluylene Orange R, Dianil Red R, Aurophenne etc.; or Thiogene colours may be employed.

The direct printing of Solid Green and Solid Green Bistre has already been described on page 265.

Resorcine Padding Baths.

| | Green | Brown I | Brown II |
|--|-------------|-------------|--------------|
| Tragacanth (60:1000) | 300 parts | 300 parts | 300 parts |
| Resorcine | 110 „ | 164 „ | 164 „ |
| Water | 100 „ | 100 „ | 100 „ |
| Ice | 700 „ | 1000 „ | 1000 „ |
| Hydrochloric acid 36° Tw. | 236 „ | 358 „ | 358 „ |
| added gradually | | | |
| Nitrite | 140 „ | 224 „ | 224 „ |
| Ice Water | 560 „ | 750 „ | 600 „ |
| allowed to react for a time, then poured into | | | |
| Tragacanth (60:1000) | 400 „ | 400 „ | 400 „ |
| Water | 5000 „ | 5000 „ | 4000 „ |
| Ammonia 25% | 350 „ | — „ | 600 „ |
| Soda lye 76° Tw. | — „ | 415 „ | — „ |
| added | | | |
| Red Prussiate of Potash (250:1000) | 1000 „ | — „ | — „ |
| Phenylene Diamine | — „ | — „ | 75 „ |
| Ammoniacal Alkaline | — „ | 600 „ | — „ |
| Copper solution | | | |
| Water | 1000 „ | 1000 „ | 2000 „ |
| Para Soap PN | 100 „ | 100 „ | — „ |
| Ammonia 25% | 50 „ | 50 „ | — „ |
| and finally | | | |
| Sodium Chlorate 300:1000 | 100 „ | 100 „ | 100 „ |
| | 10000 parts | 10000 parts | 10000 parts. |

Ammoniacal Copper Solution.

50 parts Copper Sulphate crystals,
850 „ Water,
100 „ Ammonia 25%.

Resist Colours for Nitroso Brown and Nitroso Green.

White Resist.

| | |
|-------------------|-----------------------------|
| 250 parts | British gum powder, |
| 250 „ | Potassium Sulphite 91° Tw., |
| 250 „ | Bisulphite of Soda 72° T., |
| 150 „ | China clay paste 1:1, |
| 100 „ | Water |
| | heated and then cooled. |
| <hr/> 1000 parts. | |

| Coloured Resists | Red | Orange | Blue | Yellow |
|----------------------------------|------------------|------------------|------------------|-------------------|
| Dianil Red R . . . | 50 parts | — parts | — parts | — parts |
| Toluylene Orange R . | — „ | 40 „ | — „ | — „ |
| Dianil Blue H ₂ G . . | — „ | — „ | 10 „ | — „ |
| Aurophenine O . . . | — „ | — „ | — „ | 40 „ |
| Boiling Water . . . | 450 „ | 410 „ | 440 „ | 420 „ |
| Glycerine | 50 „ | 50 „ | 50 „ | 50 „ |
| British Gum powder . | 200 „ | 250 „ | 250 „ | 250 „ |
| heated, cooled and added | | | | |
| Potassium Sulphite 91° Tw. | 200 „ | 200 „ | 200 „ | 200 „ |
| Bisulphite of Soda 72° Tw. | 50 „ | 50 „ | 50 „ | 50 „ |
| | <hr/> 1000 parts | <hr/> 1000 parts | <hr/> 1000 parts | <hr/> 1000 parts. |

IX.

INSOLUBLE AZO COLOURS PRODUCED ON THE FIBRE.

The necessary instructions for the dyeing of plain shades have already been given in the chapter on cotton dyeing, page 158 etc.

The following are the methods for the production of Azo Colour styles in printing.

- A. Printing with thickened Naphtol solutions and subsequent dyeing in Diazo solutions.
- B. Printing with thickened Diazo solutions on material prepared with Naphtol solutions.
- C. Padding with Naphtol solutions and subsequent dyeing in Diazo solutions.
- D. Production of Azo Colours by coupling dyestuffs of the Vesuvine or Chrysoidine series with Diazo compounds.
- E. Resist Effects on Insoluble Azo Colours.
- F. Discharge Effects on Insoluble Azo Colours.

A. Printing with thickened Naphtol solutions and subsequent dyeing in Diazo solutions.

This method of producing Insoluble Azo Colours, which yields very good results, is now rarely used, and is only employed for simple styles. The Naphtol printing colour described below is printed and the pieces then dried carefully and at not too high a temperature, so as to prevent the Naphtol from sublimating.

| 1. Naphtol Printing Colour A. | 2. Naphtol Printing Colour B. |
|---|----------------------------------|
| (for Paranitraniline and Azophor Red). | (for Alpha Naphtylamine Claret). |
| 30 parts Beta Naphtol, | 30 parts Beta Naphtol, |
| 370 „ Hot water. | 400 „ Hot Water, |
| 70 „ Soda lye 36° Tw., | 70 „ Soda lye 36° Tw., |
| 500 „ Tragacanth (60:1000), | 500 „ Tragacanth (60:1000). |
| 30 „ Para Soap PN, | 1000 parts. |
| 1000 parts. | |

The Naphtol prints are then developed on the padding machine in the Diazo solutions of Paranitraniline and Alpha Naphtylamine etc., washed and soaped.

B. Printing with thickened Diazo solutions on material prepared with Naphtol solutions.

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. |
|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| Beta Naphtol | 25 | — | 16 | 25 | 22 | 25 | — | 25 | 30 parts |
| Beta Naphtol R | — | 25 | — | — | — | — | — | — | „ |
| Alpha Naphtol | — | — | — | — | 3 | — | — | — | „ |
| Naphtol D | — | — | — | — | — | — | 25 | — | „ |
| Hot water | 200 | 200 | 200 | 200 | 200 | 200 | 200 | — | „ |
| Soda lye 36° Tw. | 47 | 59 | 38 | 47 | 47 | 59 | 59 | 59 | 70 „ |
| Para Soap PN | 25 | 25 | 20 | — | — | 50 | 50 | — | 25 „ |
| Tragacanth (60:1000) | — | — | — | 75 | 50 | — | — | 100 | 35 „ |
| Acetate of Soda crystals | — | — | — | — | — | 15 | 15 | — | 30 „ |
| Water | — | — | — | 500 | — | 500 | 500 | — | „ |

made up to 1000 parts.

| | 10. | 11. | 12. |
|------------------------|-----|-----|----------|
| Beta Naphtol R | — | — | 25 parts |
| Beta Naphtol | 25 | 25 | — „ |
| Soda lye 36° Tw. | 47 | 47 | 59 „ |
| Hot Water | 100 | 100 | 200 „ |
| Hydrate of Alumina 50% | 20 | — | — „ |
| Soda lye 36° Tw. | 18 | — | — „ |
| Neutral Para Soap PN | 25 | — | 20 „ |
| Hot water | 200 | 200 | — „ |
| Tragacanth (60:1000) | 80 | 80 | — „ |
| Powdered Tartar Emetic | 3 | 3 | 3 „ |
| Glycerine | 30 | 30 | 30 „ |
| Hot water | 100 | 100 | 100 „ |

made up to 1000 parts.

The various groundings are employed as follows:

- 1 and 2 for Para Red and Metanitriline.
- 2 „ bluish Para Red.
- 3 „ Azo Pink BB, NA and Blue Red O.
- 4 and 5 „ Alpha Naphtylamine Claret, Benzidine and Tolidine Puce.
- 6 and 7 „ Dianisidine Naphtol Blue and Azophor Blue.
- 8 „ Azophor Black,
- 9 „ mixed Diazo compounds,
- 10 „ drying over the cylinder (Paranitriline Red),
- 11 „ drying over the cylinder (Alpha Naphtylamine Claret),
- 12 „ Ice-colour printing styles, which are passed through the Mather-Platt.

It is advisable, when drying on the cylinder machine, to wrap the first two or three drums with a light cotton cloth, and to avoid over-heating the material.

2. Diazo Printing Colours.

In order to reduce to a minimum the liability of the Diazo solutions to decompose in printing, it is advisable:

1. to prepare the Diazo printing colours in small portions, and only to add the Sodium Acetate required for neutralising the free mineral acid immediately before printing.
2. to use small copper furnishing boxes, which can be cooled with cold water or, still better, with ice.
3. to print on the doctor instead of using a colour box when working with colours which froth so that only a small portion of the colour is exposed at a time to decomposition and is continually replenished by fresh colour.
4. to keep the Naphtol prepare strongly alkaline, or to add to it Sodium Acetate.
5. to use brush furnishers in order to prevent sticky decomposition products from clogging the engraving.

As thickening agents, Tragacanth-, Flour-tragacanth and Starch-tragacanth thickenings are employed. Dextrine produces an unstable printing colour. If the Sodium Acetate necessary for neutralising the free acid, be replaced by Sodium Phosphate, more stable printing colours are obtained and Para Red becomes somewhat bluer in shade.

Recent observations have shown that Maize-starch is the best thickening agent for Azo colours. Printing colours thickened with Maize-starch give sharp, well defined patterns and do not bleed into the white.

Maize Starch Thickening.

1790 parts Maize-starch made into a paste with
 7860 „ Water and
 350 „ Castor oil, heated to 175—185° F. stirred for 10 minutes
 and then cooled,

10000 parts.

Para Red.

Diazo printing colours not containing Ice, may be prepared according to the following methods

1 The two thickened stock colours are first prepared, the one containing the Nitrite, and the other the Base to be diazotised and the acid; before use both colours are mixed together.

2. The Paranitraniline is diazotised with the addition of Sodium Phosphate; this method is carried out according to the following recipe, and produces a bright, bluish red. Further, Paranitraniline can be diazotised without the use of Ice, when the mineral acid is replaced by Oxalic acid

After printing, the goods are dried, washed and soaped. In order to prevent the staining of the white, the printed pieces may be passed through the Mather Platt; or they are quickly passed, before washing, through a hot, weak acid bath, or through a boiling soap liquor, or a hot dilute Naphtol solution.

For Para Red printing colours are used Paranitraniline powder extra and Azophor Red PN on prepares No. 1, 2, 10 and 12 (page 319).

Paranitraniline Red Printing Colour I.

(Diazotised after dissolving with acid.)

22 parts Paranitraniline are dissolved in
 120 „ Hot water and
 41.3 „ Hydrochloric acid 36° Tw., then cooled
 and
 200 „ Ice and Water
 42 „ Nitrite solution (290 parts per 1000) added;
 made up to 470 parts, filtered and mixed into
 500 „ Tragacanth (60:1000) and before use
 30—40 „ Sodium Acetate crystals are added.
 1000 parts.

Paranitraniline Red Printing Colour II.

(Diazotised with Nitrite paste.)

22 parts Paranitraniline are made into a paste with
 42 „ Nitrite solution (290 parts per 1000) and
 80 „ Cold water, and whilst being stirred, slowly
 poured into a mixture of
 250 „ Ice and Water and
 41.3 „ Muric acid 36° Tw., allowed to stand for
 1/4 of an hour, then filtered,
 made up to 470 parts and mixed into
 500 „ Tragacanth (60:1000). Before use
 30—40 „ Sodium Acetate crystals are added.
 1000 parts.

Paranitraniline Red Printing Colour III
(Diazotised without Ice)

| | | |
|------|--------|--|
| 22.5 | parts | Paranitraniline extra are made into a smooth paste with the solution of |
| 37 | .. | Sodium Phosphate crystals in |
| 75 | .. | Water, and the mixture of |
| 20 | .. | Sulphuric acid 169° Tw. and |
| 132 | .. | Cold water is then added. After being well mixed the solution of |
| 13.5 | .. | Sodium Nitrite crystals and |
| 50 | .. | Cold water is poured gradually into the mixture. When properly diazotised, the liquid is filtered and thickened with |
| 650 | .. | Tragacanth thickening |
| 1000 | parts. | |

Printing Colour with Azophor Red PN.

| | | |
|------------|-------------|---|
| 90 | parts | Azophor Red PN are dissolved in |
| 350 | .. | Cold water, left to stand for $\frac{1}{2}$ an hour, filtered, and the filtrate slowly diluted and neutralised with |
| 47 | .. | Soda lye 36° Tw. in |
| 100 | .. | Water. This solution is stirred into |
| 500 | .. | Flour- or Starch-tragacanth thickening (page 251), and |
| 5-10 | .. | Sodium Acetate crystals are then added: |
| made up to | 1000 parts. | |

Orange

Metanitraniline and Azophor Orange MN are employed in exactly the same way as Paranitraniline and Azophor Red PN. In addition, Orthonitrotoluidine is also used for Orange. Azo Orange NA is used in the same way as Azo Pink NA (page 326).

Orthonitrotoluidine Printing Colour.

| | | |
|------|--------|--|
| 30 | parts | Nitrotoluidine are dissolved in |
| 200 | .. | Hot water, and |
| 50 | .. | Muriatic acid 36° Tw., and cooled whilst being well stirred; |
| 100 | .. | Ice are then added, and at 32-41° F., |
| 52 | .. | Nitrite solution (290 : 1000) slowly poured into it. After $\frac{1}{4}$ hour diluted to the solution is |
| 500 | parts | and filtered. |
| 400 | .. | of this Diazo solution are stirred into |
| 500 | .. | Tragacanth (60 : 1000) and before printing |
| 40 | .. | Acetate of Soda crystals and |
| 60 | .. | Water are added. |
| 1000 | parts. | |

Scarlet.

For the production of fiery Scarlet shades Chloranisidine is used. Its diazo-compound is printed in the usual manner upon the Naphtol prepare which is generally used for Para Red.

DIAZO SOLUTION

| | | |
|--|-------|--|
| 20 | parts | Chloranilidme Salt M are dissolved in |
| 200 | „ | Water, then |
| 200 | „ | Ice and |
| 23.6 | „ | Muriatic acid 36° Tw. are added. Whilst being stirred |
| 26 | „ | Nitrite solution (200 : 1000) are poured slowly into it. |
| and the solution filtered and made up to | | |

500 parts

Printing Colour.

| | | |
|-------------|-------|-------------------------|
| 470 | parts | Tragacanth (60 : 1000). |
| 500 | „ | Diazo-solution, |
| 30 | „ | Sodium Acetate crystals |
| 1000 parts. | | |

Alpha Naphtylamine Claret

For the production of this colour, Alpha Naphtylamine Base Alpha Naphtylamine Hydrochloride paste 36% and Alpha Naphtylamine Salt S powder are used.

The latter product may be diazotised without Ice. The Naphtol prepares employed are No. 4, 5 and 11 (page 319).

Alpha Naphtylamine Printing Colour made from the Base.

| | | | |
|------|--------|---|---------------------|
| 20 | parts | Alpha Naphtylamine Base | } are dissolved hot |
| 200 | „ | Water | |
| 14.4 | „ | Hydrochloric acid 36° Tw.. | } then cooled and |
| 150 | „ | Ice added After that | |
| 28.1 | „ | Hydrochloric acid 36° Tw. and at 32° F.. | |
| 37.5 | „ | Nitrite solution (240 : 1000) are slowly stirred into the liquid, which is then left to stand for 10 minutes, filtered and made up to | |
| 500 | parts. | Then stirred into | |
| 460 | „ | Tragacanth (60 : 1000). Before use | |
| 40 | „ | Sodium Acetate crystals are added. | |

1000 parts

Alpha Naphtylamine Printing Colour made from Alpha Naphtylamine Hydrochloride Paste 36%.

| | | |
|-------------|--------|---|
| 70 | parts | Alpha Naphtylamine Hydrochloride paste 36% are mixed with |
| 100 | „ | Water, |
| 200 | „ | Ice and |
| 34.2 | „ | Hydrochloric acid 36° Tw and at 32° F., |
| 37.5 | „ | Nitrite solution (290 : 1000) slowly stirred into the liquid, which is then left to stand for 10 minutes, made up to. |
| 460 | parts, | filtered and stirred into |
| 500 | „ | Tragacanth (60 : 1000). Before use |
| 40 | „ | Sodium Acetate crystals are added. |
| 1000 parts. | | |

Alpha Naphthylamine Printing Colour made from Alpha Naphthylamine Salt S powder

| | | |
|-------------|------|--|
| { | 28 | parts Alpha Naphthylamine Salt S powder are made into a paste with |
| | 100 | .. Water, and |
| | 150 | .. Ice are added |
| | 14 4 | .. Sulphuric acid 169° Tw. and |
| { | 100 | .. Ice added; then |
| | 37.5 | .. Nitrite solution (290 1000) are slowly stirred into the liquid at about 32° F.; left to stand for 10 minutes and made up to |
| <hr/> | | |
| | 460 | parts, then stirred into |
| | 500 | .. Tragacanth (60:1000). Before use |
| | 40 | .. Sodium Acetate cryst. are added |
| <hr/> | | |
| 1000 parts. | | |

Alpha Naphthylamine Printing Colour without Ice.

| | | |
|---|------|--|
| { | 28 | parts Alpha Naphthylamine Salt S powder are made into a paste with |
| | 100 | .. Water and thickened with |
| | 250 | .. Wheat Starch tragacanth thickening, then |
| | 100 | .. Water and |
| { | 20 | .. Sulphuric acid 169° Tw added |
| | 250 | parts Wheat Starch tragacanth thickening. |
| { | 37 5 | .. Nitrite solution (290. 1000), |
| | 150 | .. Water. |
| <hr/> | | |
| Before use 40-50.. Sodium Acetate crystals are added and the whole made up to | | |
| <hr/> | | |
| 1000 parts. | | |

Dianisidine Naphtol Blue.

The characteristic feature of Dianisidine Naphtol-Blue, which is distinguished for its fastness to light and soap, is the additional employment of Copper salts in its preparation.

The following Dianisidine compounds are put upon the market:

| | |
|-----------------------------|-------------------|
| Dianisidine Salt dry, | Dianisidine Base, |
| Dianisidine Salt moist 60%. | Azophor Blue D, |
| Dianisidine Sulph. G. | |

10. Naphtol prepare 6 and 7 (page 319).

Printing Colour made from Dianisidine Salt.

| | | |
|-------------|------|--|
| A. | 16 5 | parts Dianisidine Salt dry, are made into a paste with |
| | 11.8 | .. Muriatic acid 36° Tw and |
| | 45 | .. Hot water, then cooled with |
| | 300 | .. Ice water, and at 32-41° F. |
| | 28 | .. Nitrite solution (290 1000) added |
| <hr/> | | |
| 500 parts | | |
| B. | 350 | .. of this Diazo solution, are stirred into |
| | 500 | .. Flour tragacanth thickening, (page 251), to which are added |
| | 50 | .. Copper Chloride 77° Tw. and |
| | 100 | .. Water. |
| <hr/> | | |
| 1000 parts. | | |

In the foregoing recipe 16.5 parts Diamidine Salt dry may be replaced by 20.5 parts Diamidine Salt moist. or 12.5 parts Diamidine Base; in the latter case instead of 11.8 parts Muritic 36° Tw. 17.7 parts are used.

Printing Colour made from Azophor Blue D.

- | | | |
|----|---|---|
| A. | { | 36 parts Azophor Blue D are dissolved in |
| | | 300 „ Cold water, filtered and made up to |
| | | 350 parts, then stirred into |
| B. | { | 576 „ Flour-tragacanth thickening |
| | | 70 „ Copper Chloride 77° Tw and |
| | | 4 „ Chromic acid crystals added |
| | | 1000 parts. |

Benzidine and Tolidine Brown

Benzidine Base, Benzidine Sulphate and Tolidine Base are used upon Naphtol prepare 4 (page 319).

Tolidine Brown is somewhat faster to light than Benzidine Brown.

Printing Colour.

- | |
|--|
| 14.4 parts Benzidine Base or |
| 17 „ Tolidine Base are dissolved at the boil in |
| 150 „ Water and |
| 18.8 „ Hydrochloric acid 36° Tw ; after cooling |
| 200 „ Ice and |
| 31.8 „ Hydrochloric acid 36° Tw. are added, and then at 32° F. |
| 41.6 „ Nitrite solution (290 parts in 1000) slowly stirred into the liquid. The whole is left to stand for 5—10 minutes. then made up to |
| 500 parts and stirred into, |
| 458 „ Tragacanth (60.1000). Before use |
| 42 „ Sodium Acetate crystals are added. |
| 1000 parts. |

For the production of pink upon a naphtol prepare, the following are used: Blue Red O, Azo Pink BB, NA and Azophor Pink A.

Blue Red O (Nitrophenetidine 25%).

For light shades which are to be printed upon material prepared with concentrated Naphtol solution, it is necessary to keep the printing colour correspondingly acid, so that the excess of alkali in the prepare is sufficiently counteracted.

Diazo Solution

- | |
|--|
| 146 parts Blue Red O (Nitrophenetidine 25%) are carefully mixed with |
| 66 „ Nitrite solution (290 parts per 1000) and |
| 40 „ Water, and are then slowly poured into a mixture of |
| 94.4 „ Hydrochloric acid 36° Tw. at 77° F. and |
| 250 „ Water When completely dissolved, the liquid is diluted to |
| 1000 parts and filtered. |

The Diazo solution is distinguished for great stability.

Printing Colours.

| | Light Pink. | Dark Pink. |
|-------------------------|-------------|------------|
| Diazo solution | 150 parts | 500 parts |
| Tragacanth (60 1000) | 600 „ | 450 „ |
| Water | 80 „ | — „ |
| Acetic acid 9° Tw | 150 „ | — „ |
| Sodium Acetate crystals | 20 „ | 50 „ |
| | 1000 parts | 1000 parts |

Azo Pink BB

By means of Azo Pink BB bluish pink shades are obtained, but in dark shades a scarlet is produced which is distinguished for its bluish hue. The diazotising of Azo Pink BB is best carried out at a low temperature. It is to be noted that the Diazo-compound is liable to crystallise if the solutions are very concentrated, or too cold.

Diazo Solution

| | |
|------|---|
| 26 | parts Azo Pink BB are well mixed with |
| 72 | „ Cold water and |
| 30 7 | „ Hydrochloric acid 36° Tw., then |
| 100 | „ Ice and |
| 200 | „ Water, and whilst being slowly stirred, |
| 26 | „ Nitrite solution (290 parts per 1000) are added. After |
| | being left to stand for some time, the solution is filtered |
| | and diluted with cold water to |
| 500 | parts. |

Printing Colours.

| Red | Pink. |
|---------------------------------|----------------------------------|
| 460 parts Tragacanth (60 1000). | 500 parts Tragacanth (60, 1000). |
| 500 „ Diazo solution, | 60 „ Diazo solution, |
| 40 „ Sodium Acetate | 75 „ Acetic acid 9° Tw., |
| crystals. | 355 „ Water, |
| 1000 parts. | 10 „ Sodium Acetate |
| | crystals |
| | 1000 parts. |

Azo Pink NA (p-Nitro-o-Anisidine).

Azo Pink NA yields in dark shades a bright red, in light shades a pink resembling that of Alizarine. The fastness properties of this colour are satisfactory. It is especially distinguished on account of the fastness to Chlorate of its Diazo compound, which renders it suitable as an addition to coloured Chlorate discharges.

Diazo Solution.

| | |
|------|--|
| 67.5 | parts Azo Pink NA are mixed with |
| 125 | „ Water. |
| 325 | „ Water, |
| 71.5 | „ Sulphuric acid 169° Tw. |
| 250 | „ „, are then added slowly, and afterwards |
| 30 | „ Nitrite dissolved in |
| 125 | „ Water. |

After being allowed to stand for a short time, the liquor is filtered, and made up with cold water to

1000 parts.

Printing Colours.

| | Red | Pink |
|----------------------|------------|-------------|
| Diazo Solution | 270 | 70 parts |
| Tragacanth (60:1000) | 500 | 500 .. |
| Water | 205 | 370 .. |
| Acetic acid 50% | — | 50 .. |
| Acetate of Soda | 25 | 10 .. |
| | 1000 parts | 1000 parts. |

Azophor Pink A.

With Azophor Pink A a brilliant yellowish pink is obtained upon a Naphtol ground. For light shades the printing colours contain Acetic acid, in order to neutralise the alkali of the strong Naphtol prepare, and to produce even results.

Printing Colour.

| | |
|--|--|
| 20 parts Azophor Pink A are dissolved in | |
| 400 .. Cold water, left to stand for 1½ hours, filtered, and | |
| 45 .. Acetic acid 9° Tw added. The whole is then diluted to | |
| 500 parts, with water, thickened with | |
| 485 .. Tragacanth (60:1000) and before use | |
| 15 .. Sodium Acetate cryst. are added. | |
| 1000 parts. | |

Black.

For the production of Insoluble Black Azo Colours upon the fibre:

Azophor Black S and Azophor Black DP are used

In order to obtain a perfect solution, the use of Acetic acid as a solvent for Azophor Black S is to be recommended. The excess of acid is neutralised in this case by means of Caustic Soda. A deeper black is produced on a prepare containing Tragacanth than on one containing Para Soap. Where deeply engraved printing rollers are used the Azophor Black S printing colour must be correspondingly reduced, as otherwise brownish blacks may easily result; it is advisable to use rather thick printing colours.

| Printing Colour made from Azophor Black S. | Printing Colour made from Azophor Black DP |
|--|--|
| 80 parts Azophor Black S, are dissolved cold in | 80 parts Azophor Black DP, |
| 100 .. Acetic acid 9° Tw., and | 380 .. Water, |
| 145 .. Water; then | 500 .. Flour-tragacanth thickening, |
| 95 .. Soda lye 36° Tw. and | 40 .. Sodium Acetate |
| 80 .. cold water are slowly added, and the whole thickened with | crystals. |
| 500 .. Flour-tragacanth thickening (page 251), Strained before printing. | 1000 parts |
| 1000 parts. | |

Azophor Black may also be used for producing puce shades.

| | | |
|-------|-------------------|---------------------------------------|
| e. g. | 30 parts | Azophor Black DP, |
| | 405 | „ Water, |
| | 550 | „ Maize-starch-thickening (page 321). |
| | 15 | „ Sodium Acetate crystals. |
| | <hr/> 1000 parts. | |

Printing along with Ice Colours.

The Insoluble Azo Colours are very often printed in conjunction with other dyestuffs which are easily fixed by short steaming. Naphtol prepare No. 12, page 319 is used.

If small amounts of Antimony are added to the prepare, the fastness of these colours is increased

The following dyestuffs can be printed along with Insoluble Azo Colours:

Auramine, Methylene Yellow H, Flavophosphine, Rosazeine 4G, Safranin, Methyl Violet, Marine Blue, Victoria Blue, Methylene Blue, Thionine Blue, Ethyl Blue, Malachite Green, Brilliant Green, Alizarine Blue S, Ceruleine S, Chromoglaucine VM, BMI powder, Philochromine B and G paste etc.

The printing recipe* is as follows

| | |
|-------------------|--------------------------------------|
| 20—30 parts | Basic dyestuff, |
| 200 | „ Acetic acid 9° Tw , |
| 25 | „ Citric acid, |
| 350 | „ Acid starch thickening (page 251), |
| 200 | „ Tragacanth (60.1000), |
| 45—103 | „ Water, |
| 100—150 | „ Acetic Acid Tannin solution 1:1. |
| <hr/> 1000 parts. | |

C. Padding with Naphtol Solutions and subsequent Dyeing with Diazo Solutions.

The dyeing of the Insoluble Azo Colours produced on the fibre has already been described in the chapter on cotton dyeing (page 163).

D. Production of Azo Colours by coupling dyestuffs of the Vesuvine or Chrysoidine series with Diazo compounds.

Brown Salt G and R, and Dark Brown Salt G and R are products belonging to the Vesuvine and Chrysoidine series, which give full brown shades when coupled with diazotised Parantraniline. These shades are faster to light than Benzidine and Tolidine Puce.

The bleached cotton cloth is padded with the solutions of Brown Salt G (Vesuvine) or Brown Salt R (Chrysoidine) to which some Acetic acid and Tragacanth thickening are added in order to prevent them from bronzing. The Dark Brown Salts are more soluble than the ordinary Brown Salts and are dissolved without the addition of Acetic acid. They are slightly acid and therefore require a small addition of Acetate of Soda to the padding bath in order to

neutralise the free acid. The goods are then dried in the hot flue or on the cylinder drying machine, and afterwards passed through the solution of Paranitrodiazobenzene neutralised with Sodium Acetate. This passage must not be too short, and the goods must lie for $\frac{1}{4}$ of an hour before being washed. Brown Salt G and Dark Brown Salt G give more yellowish shades than Brown Salt R and Dark Brown Salt R. — The goods are then washed, soaped and dried. By printing with thickened Brown Salt solutions upon white or naphtholated material and subsequent dyeing with Parantrianiline various excellent effects can also be produced.

Prepare for Dark Para Brown

| | |
|-------------|-------------------------|
| 15 parts | Dark Brown Salt G or R, |
| 500 „ | Hot water, |
| 100 „ | Tragacanth (60:1000), |
| 3 „ | Sodium Acetate, |
| 350 „ | Water, |
| | made up to |
| 1000 parts. | |

Prepare for Para Brown

| | |
|------------|-----------------------|
| 15 parts | Brown Salt R or G, |
| 200 „ | Boiling water, |
| 50 „ | Acetic acid 9° Tw, |
| 50 „ | Tragacanth (60:1000), |
| | made up with water to |
| 1000 parts | |

E. Resist styles on Insoluble Azo Colours.

The following resists are to be distinguished: 1. Tin Resists, 2 Sulphite Resists, 3. Tannin Resists. 4. Persulphate Resists.

1. Tin Resists.

Stannous salts, especially Tin crystals in the presence of fixed organic acids (Tartaric and Citric acids), act as resists for the Insoluble Azo Colours. In order to increase their resisting power, additions of China clay, Glue, Wax etc. are made.

Tin resists tend to produce yellowish whites; therefore in order to clear the whites and to remove all trace of Tin compounds still adhering to the fibre, the goods are soured at full width in a liquor containing Sulphuric and Oxalic acids.

The coloured tin re-sists are generally prepared with Basic dyestuffs which withstand the reduction, or with Pigment colours, e. g. Auramine, Methylene Yellow H, Flavophosphine, Phosphine, Rosazene 4G extra, 6G extra, 6GD extra, Methyl Violet, Marine Blue, Victoria Blue, Methylene Blue, Thionine Blue, Ethyl Blue, Malachite Green, Brilliant Green, Chrome Yellow. Chrome Orange and Guignet Green.

a) White Resists.

| White Resist I | | White Resist II. | |
|------------------|----------------------|-------------------|---------------------------------------|
| 450 parts | Tin crystals. | 250 parts | Acid starch thickening (page 251). |
| 450 .. | Gum sol. 1.1, | 250 .. | Tin crystals, |
| 50 .. | Tartaric acid. | 50 .. | Tartaric acid, |
| 50 .. | Glycerine. | 350 .. | Glue solution 1:2. |
| 1000 parts. | | 100 .. | China clay. |
| | | 1000 parts. | |
| White Resist III | | Glue Solution 1:2 | |
| 225 parts | British gum pdr , | 335 parts | Glue are soaked in |
| 225 .. | Water, | 415 .. | Water and heated, till |
| 150 .. | Tin crystals. | | completely dissolved, |
| 50 .. | Tartaric acid, | | with the addition of |
| 350 .. | Sodium Tartar emetic | 250 .. | Acetic acid 9° Tw. The |
| 1000 parts. | | | loss in weight caused |
| | | | by boiling is made up |
| | | | with diluted Acetic |
| | | | acid, |
| | | 1000 parts | |

If Antimony compounds are added to the white resists, covers with Basic colours can be resisted.

b) Coloured Resists.

| a) with Basic dyestuffs. | b) with Pigment colours. |
|--------------------------|--------------------------|
| 25-30 parts | Chrome Yellow Z |
| 25 .. | Water, |
| 100 .. | Acetic acid |
| | 9° Tw., |
| 500 .. | Acid starch |
| | thickening, |
| 50 .. | Tartaric acid, |
| 50 .. | Glycerine, |
| 100-120 .. | Acetic acid tan- |
| | nin sol 1:1, |
| 150 .. | Tin crystals, |
| 1000 parts. | 1000 parts. |

2 Sulphite Resists

Sulphite compounds act as powerful resists, and under Paranitraniline Red or Azophor Red, produce purer whites than the Tin resists. The latter are more suitable, however, for resisting Alpha Naphtylamine Claret.

The following are the most important Sulphite resists.

a) White Resists.

White Resist I

| | | |
|-------------|----------------------------|----------------------|
| 250 parts | British gum powder |) are dissolved hot. |
| 750 .. | Potassium Sulphite 91° Tw. | |
| 1000 parts. | | |

White Resist II.

| | |
|-------------|----------------------------|
| 200 parts | Oxide of Zinc pdr. |
| 300 „ | Thickening SG (page 252), |
| 500 „ | Potassium Sulphite 91° Tw. |
| <hr/> | |
| 1000 parts. | |

A very good resist for Para Red, resists also Azophor Black covers

White Resist III.

| | |
|-------------|-------------------------------|
| 120 parts | Stannous Hydrate |
| | paste are slowly stirred into |
| 60 „ | Gum solution, |
| 460 „ | Soda lye 91° Tw. then |
| 265 „ | Gum solution, |
| 55 „ | Bisulphite 71 1/2 Tw., |
| 40 „ | Glycerine are slowly added. |
| <hr/> | |
| 1000 parts. | |

This resist is used for fine patterns under heavy covers

b) For the production of Coloured Resists, Pigment colours are employed, e. g.

Blue Resist U

| | |
|-------------|--|
| 300 parts | Ultramarine powder are very finely ground with |
| 20 „ | Glycerine and |
| 180 „ | Water, then |
| 100 „ | Tragacanth (60.1000), |
| 150 „ | Albumen (1.1), |
| 250 „ | Potassium Sulphite 91° Tw are added. |
| <hr/> | |
| 1000 parts. | |

3. Tannin Resists.

Tannin has a strong resisting effect upon Diazo compounds. By means of this reaction it is possible to produce coloured resists with tannin dyestuffs, which possess great fastness to washing and soap, and surpass the Tin crystal resists in beauty and fastness.

The resisting action of Tannin is increased by the addition of certain fixed organic acids.

| | Yellow | Green | Blue |
|-----------------------------------|------------|------------|------------|
| Auramine conc. | 20 parts | — | — |
| Methylene Yellow H | — | 10 parts | — |
| Brilliant Green crystals extra | — | 6 „ | — |
| Methylene Blue DBB extra conc. | — | 4 „ | — |
| New Ethyl Blue RS | — | — | 12 parts |
| Marne Blue RI | — | — | 12 „ |
| Violet crystals O | — | — | 6 „ |
| Acetic acid 9° Tw. | 260 parts | 260 „ | 205 „ |
| Acetine | 50 „ | 50 „ | 50 „ |
| Acid starch thickening (page 251) | 550 „ | 550 „ | 535 „ |
| Tartaric acid | 20 „ | 20 „ | — „ |
| Oxalic acid | — „ | — „ | 60 „ |
| Acetic acid tannin sol. 1 1 | 100 „ | 100 „ | 120 „ |
| <hr/> | | | |
| | 1000 parts | 1000 parts | 1000 parts |

Instead of Acid starch, the thickening SG (page 252), which possesses partly mechanically resisting properties, can be used with advantage.

In order to ensure a good fixation of these tannin resists it is advisable to dry the goods thoroughly after printing, then to hang them in a warm place, or to run them over the drying cylinder. A short passage through the Mather-Platt is also often serviceable. In this case Naphtol prepare No. 12 (page 319) is used.

After steaming, the colours are developed in the Diazo bath, which is done on the 3 roller padding machine. In order to prevent the developing bath from being soiled by the squeezed-out padding liquid, the apparatus is constructed in such a manner that the superfluous developing liquid is drained off separately. Thin materials can be passed direct through the squeezing rollers of the padding machine, the lower thickly covered roller of which rotates in the developing bath. Thick materials receive a short passage through the bath. The printed side runs face upwards; the upper squeezing roller is better not wrapped. After developing, the goods are well squirted with water, washed, then passed through Tartar Emetic and finally soaped in the open.

Instead of printing with Tannin colours upon Naphtol ground the following method can be adopted: The acid tannin colours are mixed with the white material, steamed for $\frac{1}{2}$ —1 hour, then padded with the solution without being washed, and finally developed in the Diazo bath.

The following Tartar Emetic resist produces a white under the Tannin resist:

Resist PZ.

| | |
|-------------|-----------------------|
| 175 parts | British gum powder, |
| 275 " | Water, |
| 350 " | Sodium Tartar Emetic, |
| 50 " | Tartaric acid, |
| 150 " | Tin crystals |
| <hr/> | |
| 1000 parts. | |

4. Persulphate Resists.

The Persulphate resist process is used for the production of Blue Red styles by means of Dianisidine Naphtol Blue and Para Red.

If a Dianisidine Naphtol Blue printing colour containing copper and mixed with Persulphate is printed upon naphtolated goods, the Dianisidine Naphtol Blue is formed at once, and the superfluous Naphtol still remaining on the printed places is made ineffective by the Persulphate, so that in subsequently dyeing with Paranitrodiazobenzene, pure blue patterns on a red ground are obtained. In order to obviate the injurious brown colouring, the Copper salt of the Dianisidine printing colour up to 1% is replaced by Para Red, a certain quantity of Oxalate of Ammonia is added to the red developing bath and the subsequent soap bath. This prevents the red from forming the brown copper lake.

| Naphtol Prepare D. | | Dianisidine Solution. | |
|-------------------------|------------------------|-----------------------|-----------------------|
| 20 parts | Beta Naphtol D, | 16.5 parts | Dianisidine Salt dry, |
| 32 .. | Soda lye 36° Tw., | 100 .. | Water, |
| 500 .. | Hot water, | 11.5 .. | Hydrochloric acid |
| 30 .. | Para Soap PN, | | 36° Tw, |
| 30 .. | Sodium Acetate | | When dissolved |
| | crystals, | 250 .. | Ice and |
| | made up with water to | 28 .. | Nitrite solution |
| 1000 parts. | | | (290:1000) |
| | | | are slowly added. |
| | | | When completely |
| | | | Diazotised, made up |
| | | | with water to. |
| | | 400 parts. | |
| Blue Printing Colour D. | | Developing Bath. | |
| 500 parts | Flour thickening (page | 14 parts | Paranitraniline extra |
| | 251), | | diazotised and mixed |
| 400 .. | Dianisidine sol, | | with |
| 50 .. | Potassium Persulphate | 30 .. | Sodium Acetate cryst. |
| | cryst., | | and |
| 40 .. | Copper Chloride 77° | 20 .. | Oxalate of Ammonia |
| | Tw., | | cryst. and made up |
| 10 .. | Water. | | with water to. |
| 1000 parts. | | 1000 parts. | |

After a thorough washing the goods are soaped in the open with soap and Oxalate of Ammonia, and again, if required, in rope form in the same manner

F. Discharging of Insoluble Azo Colours.

The discharging of Insoluble Azo Colours with Hydrosulphite NF and Hydrosulphite NF conc has superseded the different resist processes in most cases. In the following section we shall describe the processes of discharging with Hydrosulphite.

HYDROSULPHITE DISCHARGES.

The introduction of the Hydrosulphite compounds as discharging agents in printing, dates back to the discovery of the stable Formaldehyde compound

This compound of Hydrosulphite is put upon the market under the names:

Hydrosulphite NF Hoechst and
Hydrosulphite NF conc. Hoechst

in the form of a white crystalline substance. Protected from dampness and from heat, the substance keeps unimpaired for many weeks in

closed vessels. It is deliquescent in a damp atmosphere and melts in the water bath at about 122° F. without losing its reducing power.

Strong alkalis favour the decomposition when heated; bisulphite destroys the compound at a cold temperature, as do also strong acids.

In preparing the discharge colours, the Hydrosulphite NF is dissolved in a little water by gently heating, and the thickening added.

For Diamil colours and insoluble Azo colours the Hydrosulphite NF discharges are the most important; they are also used for producing coloured discharges with certain Basic colours. The Diamil colours, Para Red, Para Brown, Para Dark Brown, Metanitriline Orange, Amido Azo Benzole Red, Amido Azo Toluol Claret and others. Insoluble Azo colours are easily discharged white. Alpha Naphthylamine Claret requires steaming for some time above 212° F. However, if additions of Patent Blue, Induline Scarlet, Anthraquinone etc. are made, the time of steaming may be considerably reduced.

If Induline Scarlet is used 1.5 to 3% is added to the Diazobath, or about 2% (of the weight of the Hydrosulphite) is added to the discharge colour.

Hydrosulphite NF conc. special, is a product containing all the necessary additions for the discharging of Naphthylamine Claret etc.

When using Patent Blue, larger quantities are required, and in addition, the discharge pastes must also contain Formaldehyde and Phenol in order to prevent the premature reduction of the Patent Blue, and to render the discharge pastes more stable. Patent Blue discharge pastes require a shorter steaming operation and give purer whites than the Induline Scarlet discharges pastes.

C. H. Sünder discovered that by adding Anthraquinone and a little Caustic Soda to the Hydrosulphite discharge pastes, it is possible, by steaming for a short time, to discharge all Azo colours.

The thickening agent employed greatly influences the purity of the white; for instance, Flour and Starch thickenings give better results than Gum or Dextrine thickenings.

Certain Azo colours, e. g. Para Brown G and R are more efficiently discharged by an acid Hydrosulphite discharge paste than by a neutral or an alkaline discharge. Hydrosulphite NF conc. can be mixed with Hydrochloric or Acetic acid until a strong acid reaction takes place, without losing its efficacy, if an excess of Formaldehyde is present.

A pure white is obtained on the Superposition Puce, composed of Para Red and Steam Aniline Black, if Sodium Acetate is added to the discharge paste.

The white and coloured discharges are well dried (at not too high a temperature) after which they are steamed for 2—3 minutes in the Mather-Platt, after which they are soaped.

In order that the Mather-Platt may be as free from air as possible, the entrance for the goods must be narrow and as low as possible.

After steaming, the coloured discharged goods are allowed to lie exposed to the air, so as to bring about reoxidation; or they may be passed through a Chrome bath, which also gives good results.

Coloured discharges containing Tannin dyestuffs are given a passage through Antimony after steaming.

A. Discharging of Direct and Basic Colours.

The dischargeability of the Direct colours will be readily seen from the table at the end of this chapter.

The following colours, aftertreated with Sohldogen, are suitable for discharge styles:

Auraphenine O, Dianil Pink BD, Dianil Fast Scarlet 4BS, 6BS, 8BS, RS, GS, RS extra, Dianil Red R, 4B, 6B, 10B, Dianil Violet H, Dianil Claret Red B and G, Dianil Blue H6G, G, B, Dianil Green B and the Dianil Blacks. Further, the following colours aftertreated with Azophor Red are also suitable: Dianil Brown 3GO, 2G, R, BD, D, M, Dianil Indigo O, and the diazotised and developed shade (Phenylene Diamine) of Dianil Black ES and the direct shades of Patent Dianil Black.

For coloured discharges with Hydrosulphite, the following Basic colours are suitable: Magenta, Victoria Blue, Victoria Green, Victoria Blue, Azophosphine, Methyl Violet, Violet Crystals, Chrysoidine, Vesuvine, Janus Brown R, B and Janus Red B.

The composition of the discharge pastes is the same as for Para Red etc. with the exception that the colour must be reduced according to the dischargeability of the dyestuff.

In order to prevent doctor streaks the goods are padded before printing, with a solution of Sodium Chlorate (5--10 parts per 1000). After printing they are steamed for 2--3 minutes in the Mather-Platt at 212--216° F. rinsed and dried.

When printing thick, raised material, especially in white discharges, China clay, Zinc white or Lithopone, along with some Albumen solution is added to the discharge colour.

The discharge pastes are prepared as follows:

| Discharge White NF. | Thickening for Reductions. |
|----------------------------|----------------------------|
| 200 parts Hydrosulphite NF | 700 parts Flour thickening |
| conc. and | (page 251). |
| 600 „ Flour thickening are | 100 „ Water. |
| dissolved on the water | 200 „ Oxide of Zinc 1:1. |
| bath and | 1000 parts. |
| 200 „ Oxide of Zinc 1:1 | |
| added cold. | |
| 1000 parts. | |

B. White Discharges on Para Red and Para Brown.

| Discharge White NFC. | Discharge White NFS. |
|---|--|
| <div> <div>225 parts Hydrosulphite NF conc. dissolved at 122° F. in</div> <div>225 .. Gum solution 1:1.</div> <div>50 .. Glycerine.</div> <div>50 .. Water.</div> <div>450 .. Wheat starch tragacanth thickening (page 251),</div> </div> <hr/> 1000 parts. | <div> <div>225 parts Hydrosulphite NF conc. dissolved at 122° F. in</div> <div>225 .. Gum solution 1:1, cooled and</div> <div>7.5 .. Formaldehyde 40% added, then</div> <div>10 .. Hydrochloric acid 36° Tw.,</div> <div>82.5 .. Water, are slowly added and then stirred into</div> <div>450 .. Wheat starch tragacanth thickening.</div> </div> <hr/> 1000 parts |

Discharge White NFS is advantageously used for Para Brown.

For very fine designs on raised cloths, Hydrosulphite NFW Hoechst is used.

| |
|------------------------------|
| Discharge White NFW. |
| 600 parts Hydrosulphite NFW. |
| 400 .. Flour thickening. |
| <hr/> 1000 parts. |

In addition to the above, the Discharge White S prepared with Hydrosulphite NF conc. special, can also be used for discharging Paramtraniline Red and Para Brown.

C. White Discharges upon Alpha Naphtylamine Claret and Benzidine Brown etc.

| Discharge White R. | Discharge White S. |
|---|--|
| <div> <div>340 parts Wheat starch tragacanth thickening (page 251).</div> <div>50 .. Rodogen MLB,</div> <div>20 .. Sodium Pyrophosphate powder,</div> <div>50 .. Sodium Turkey Red oil 50%.</div> <div>when dissolved</div> <div>250 .. Hydrosulphite NF conc.</div> <div>250 .. Gum solution 1:2</div> <div>30 .. Glycerine and</div> <div>10 .. ultramarine</div> <div>are slowly added.</div> </div> <hr/> 1000 parts. | <div> <div>250 parts Hydrosulphite NF conc. special are dissolved by heating at 122° F. in</div> <div>150 .. Water and</div> <div>50 .. Glycerine</div> <div>and stirred into</div> <div>550 .. Wheat starch tragacanth thickening.</div> </div> <hr/> 1000 parts. |

| Discharge White NFI. | Discharge White NFP. |
|-------------------------------|--------------------------|
| 250 parts Hydrosulphite NF | 20 parts Patent Blue V, |
| conc., | 100 „ Glycerine, |
| 50 „ Glycerine, | 50 „ Water. |
| 170 „ Water, | 270 „ Wheat starch trag- |
| 500 „ Wheat starch trag- | acanth thickening are |
| acanth thickening, | dissolved then added |
| 30 „ Induline Scarlet (1.100) | cold |
| solution. | 40 „ Phenol, |
| 1000 parts. | 20 „ Formaldehyde 40%, |
| | after which is added |
| Heat until the Hydrosulphite | the solution of |
| is dissolved and the Induline | 250 „ Hydrosulphite NF |
| Scarlet reduced. | conc., |
| | 50 „ Water, |
| | 200 „ Wheat starch trag- |
| | acanth thickening. |
| | 1000 parts. |

Discharge White NFA. (Dissolved lukewarm).

| |
|--|
| 200 parts Hydrosulphite NF conc. dissolved in |
| 300 „ Gum solution 1:1, |
| 435 „ Starch tragacanth thickening (page 251), |
| 50 „ Anthraquinone paste, |
| 15 „ Caustic Soda 76 $\frac{1}{2}$ ° Tw. |
| 1000 parts. |

D. Coloured Hydrosulphite Discharges.

The following colours are suitable for coloured discharges: Methylene Yellow H, Auramine, Flavophosphine, Leather Yellow O, Thionine Blue GO, Methylene Blue, Discharge Navy Blue, Methylene Grey, Rosazeine, the Eosines, the Alizarine colours (excepting the Alizarine Yellow brands), Chrome Violet VM, BMJ, Philochromine, the Vat colours and the Thiogene colours.

For black along with the Hydrosulphite colours, Logwood Black and Thiogene Black may be used. Aniline Black and Diphenyl Black are not properly developed on account of the reducing action of the discharge pastes.

Since Hydrosulphite is decomposed by Acetic acid etc., Glycerine, Acetone, or better still Phenol is added when working with the Basic colours to prevent the premature formation of the colour lake.

a) Coloured Discharges for Para Red, Direct Colours etc.

| Coloured Discharge. | Discharge Blue VM. |
|-----------------------------|------------------------------|
| 20—30 parts Basic dyestuff, | 50 parts Chrome Violet VM |
| 30 „ Glycerine, | paste, |
| 10 „ Acetone, | 200 „ Water, |
| 180—200 „ Water, | 350 „ Wheat starch trag- |
| 300—220 „ Wheatstarch trag- | acanth thickening |
| acanth thickening, | (page 351), |
| 60 „ Phenol, | 100 „ Acetate of Chrome |
| 100 „ Aqueous Tannin | 32° Tw., |
| solution 1:1, | 300 „ Hydrosulphite thicken- |
| 300—350 „ Hydrosulphite | ing NF, |
| thickening, | 1000 parts. |
| 1000 parts. | |

Greener blues are obtained in the same manner by using Chrome Violet BMJ paste

200 parts Chrome Violet BMJ solution are equal to 50 parts of Chrome Violet VM paste.

Hydrosulphite Thickening NF.

500 parts Hydrosulphite NF conc. are dissolved at 122—140° F. in 500 „ Gum solution 1:1.

1000 parts.

Thickening for Reductions.

| |
|---|
| 300 parts Hydrosulphite thickening NF, |
| 400 „ Wheat starch tragacanth thickening, |
| 250 „ Water, |
| 25 „ Aqueous Tannin solution 1:1, |
| 25 „ Glycerine. |

1000 parts.

Discharge Pink.

| |
|---|
| 40 parts Erythrosine, Eosine or Phloxine. |
| 290 „ Water, |
| 30 „ Glycerine, |
| 200 „ British gum powder, |
| are dissolved, cooled, then slowly added |
| 100 „ Acetate of Chrome 32 $\frac{1}{2}$ ° Tw., |
| 340 „ Hydrosulphite thickening NF. |

1000 parts.

Discharges with Albumen colours.

| |
|--|
| 400 parts Tannin Lake, |
| 150 „ Albumen 1:1, |
| 100—150 „ Burnt starch 1:1, |
| 300—350 „ Hydrosulphite thickening NF. |

1000 parts.

The Tannin lake contains:

| | |
|-------------------------|------------------------|
| 50 parts Auramine conc. | } in 1000 parts upon |
| or | |
| 50 „ Thionine Blue GO | Heavy Spar substratum. |

b) For Naphtylamine Claret etc.

| Coloured Discharges with Hydrosulphite NF conc. special. | Coloured Discharges with Induline Scarlet. |
|--|--|
| 20—30 parts Basic dyestuff, | 20—30 parts Basic dyestuff, |
| 40—70 „ Water, | 40—100 „ Water, |
| 50 „ Glycerine, | 50 „ Glycerine, |
| 250 „ Wheat starch | 350 „ Wheat starch |
| tragacanth thicken- | tragacanth thicken- |
| ing (page 251), | ing, |
| 20 „ Ethyl Tartaric | 20 „ Ethyl Tartaric |
| acid 22° Tw., | acid 22° Tw., |
| 50 „ Alcohol, | 50—0 „ Alcohol, |
| 80 „ Aqueous Tannin | 80—100 „ Aqueous Tannin |
| solution 1:1, | solution 1:1, |
| 50 „ Sodium Turkey | 50 „ Sodium Turkey |
| Red oil 50%, | Red oil 50%, |
| 170—150 „ HydrosulphiteNF | 340—300 „ Hydrosulphite |
| conc. special, | thickening NFI, |
| 170—150 „ Gum solution 1:1 | 1000 parts. |
| 1000 parts. | |
| Hydrosulphite Thicken- | Discharge Blue CI. |
| ing NFI. | |
| 500 parts Hydrosulphite NF | { 50 parts Chrome Violet VM |
| conc. are heated at | { paste 40% |
| 122° F with | { 250 „ Water, |
| 450 „ Gum solution 1:2, | 400 „ stirred into |
| 1 „ Induline Scarlet and | 400 „ Wheat starch trag- |
| 49 „ Water, until the | acanth thickening, |
| Hydrosulphite NF | 100 „ Green Acetate of |
| conc is dissolved and | Chrome 32° Tw., |
| the Induline Scarlet | 250 „ Hydrosulphite thicken- |
| is completely reduced. | ing NFI. |
| 1000 parts. | 1000 parts. |

Resists under Discharges with Hydrosulphite NF conc.

By printing substances with an acid and oxidising reaction the discharge effect of overprinted Hydrosulphite can be completely neutralised.

If Antimony salts are added to these resisting substances, the Hydrosulphite coloured discharges prepared with certain Basic dyestuffs can also be thrown off. For the production of these resists fixed organic acids are to be considered, e. g. Citric or Tartaric acid, besides Chlorates, Persulphates, Chromates, Peroxide of Manganese, and Metal salts with oxidising reaction, such as Copper salts, Ferric salts etc. The most suitable are Citric or Tartaric acid in combination with Chlorate of Soda.

The latter is preferable for Para Red, as it influences the red shade favourably.

On Para Brown (R and G) the discharge effect can also be successfully resisted by means of an Alkaline Copper solution.

Chrome dyestuffs, e. g. Chrome Violet, Philochromine etc. which are easily destroyed by oxidising agents are likewise easily thrown off by the resist consisting of Citric acid and Sodium Chlorate.

Contrary to the general rule the best resist effects are obtained if the Hydrosulphite discharges are printed before the resists are dry. It is therefore expedient to print the resist under the discharge in one operation.

After printing, the goods are well dried, then steamed in the Mather-Platt for 2-3 minutes at 212-214° F., and finally finished in the usual manner.

The following recipes show the composition of the resists:

Resist I under Discharge
White for Para Red and
Para Brown.

840 parts Gum solution 1:1,
60 „ Citric acid cryst.,
100 „ Sodium Chlorate.

1000 parts.

Resist III under Discharge
Yellow for Methylene
Yellow H and Auramine.

500 parts Gum solution 1:1,
100 „ Citric acid cryst.,
200 „ Sodium Tartar Emetic,
200 „ Sodium Chlorate.

1000 parts.

Resist II under Discharge
White for Para Brown.

400 parts Burnt starch thickening
1:1,
200 „ Caustic soda 77° Tw. are
heated, then cooled and
400 „ Alkaline Copper
solution slowly stirred
into the mixture.

1000 parts.

Resist IV under Discharge
Blue for Chrome Violet.

600 parts Gum solution 1:1,
200 „ Citric acid cryst.,
200 „ Sodium Chlorate.

1000 parts.

Alkaline Copper Solution.

1000 parts Copper Chloride 77° Tw. are diluted with

500 „ Tartaric acid cryst. and

400 „ Glycerine; to the above are added in portions whilst cooling

1200 „ Soda lye 77° Tw.

Chlorate Discharges.

When properly applied, the Chlorate discharges do not injure the fibre, and they are therefore to be recommended for large surface patterns.

The Chlorate discharge is a steam discharge containing free organic acids or their Ammonium salts, along with Ferro- or Ferricyanide compounds, which latter act as Oxygen carriers and regulate the decomposition of the Chlorate; they play a similar part to the Copper-, Vanadium-, and Cerium compounds used in other oxidation colours.

Extremely energetic Chlorate discharges are obtained by means of the Chlorates of Alumina and Zinc Bromates, e. g. Ammonium Bromate, are added to the Chlorate discharges since Bromine-compounds and Bromine do not impair the fibre so much as Chlorine and the Chlorates. They are employed in combination with Alumina mordants for the production of Alizarine Red discharges on Indigo. Concentrated Chlorate discharges tend to crystallise on standing in a cool place, and these fine crystals give rise to doctor streaks; consequently the Chlorate discharge pastes must be stored in a warm place.

The steaming of the printed goods is carried out with dry steam in the Mather-Platt for 1—3 minutes at a temperature just below 212° F. The vapours containing Chlorine must be conducted out of the steaming apparatus.

The steamed goods are passed at full width through water at 140° F. for 1—2 minutes, then through dilute Caustic Soda 4.5° Tw., or through a bath containing 10 parts Caustic Soda (76° Tw.) and 10 parts Silicate of Soda (67° Tw.) per 1000 parts. In order to improve the white, the goods are subsequently soaped.

Doctor streaks may be avoided by previously preparing the goods with a small amount of Sulphite or Thiosulphate.

Chlorate discharges are employed on Basic, Mordant, and Sulphur colours, also on Indigo.

| Chlorate Discharge 1. | | Chlorate Discharge 2. | |
|-----------------------|---------------------|-----------------------|---------------------|
| 300 parts | British gum powder, | 250 parts | British gum powder, |
| 415 " | Water, | 500 " | Water, |
| 200 " | Sodium Chlorate, | 30 " | Citric acid, |
| 50 " | Yellow Prussiate of | 200 " | Sodium Chlorate, |
| | Potash, | 10 " | Red Prussiate of |
| 35 " | Citrate of Ammonia, | | Potash, |
| | 53° Tw. | 10 " | Vanadium solution |
| | | | 1:1000, |
| 1000 parts. | | 1000 parts. | |
| For Basic dyestuffs. | | For Basic dyestuffs. | |

| Chlorate Discharge 3. | | Chlorate Discharge 4. | |
|-------------------------------------|---------------------|-----------------------|---------------------|
| 220 parts | British gum powder. | 150 parts | Chlorate of Soda, |
| 50 " | Water, | 200 " | Barium Chlorate, |
| 560 " | Chlorate of Alumina | 250 " | Water, |
| | 42° Tw., | 40 " | Flour, boiled and |
| 150 " | Sodium Chlorate, | | added at 122° F.: |
| 20 " | Potassium Ferri- | 130 " | Sulphate of Alumina |
| | cyanide, | 120 " | Water, added cold |
| | | 110 " | Red Prussiate of |
| | | | Potash, |
| 1000 parts. | | 1000 parts. | |
| For Basic dyestuffs, Chrome shades. | | For Basic dyestuffs. | |

| Chlorate Discharge 5 | | Chlorate Discharge 6. | | |
|--|--------------------------|-----------------------|----------|--------------------------------------|
| 200 parts | British gum powder, | A { | 75 parts | China clay made into a paste with |
| 300 „ | Chlorate of Alumina | | 75 „ | Water, |
| 200 „ | 42° Tw., | | 200 „ | Gum solution 1:2, |
| 100 „ | Chlorate of Soda, | | 140 „ | Chlorate of Soda, |
| 50 „ | China clay 1:1, | B { | 100 „ | Powdered Tartaric acid, |
| 50 „ | Water, | | 50 „ | Water, |
| 50 „ | Red Prussiate of Potash, | | 100 „ | Gum solution 1:2, |
| 100 „ | Citric acid, | | 16 „ | Powdered Yellow Prussiate of Potash, |
| 1000 parts. | | | 44 „ | Water, |
| | | | 200 „ | Gum solution 1:2, |
| | | 1000 parts. | | |
| For fine discharge patterns on Thiogene colours. | | For Mordant colours. | | |

| Chlorate Discharge 7. | | Thickening for Reducing Pastes. | |
|-----------------------|-----------|--|-------------|
| { | 375 parts | Wheat starch tragacanth thickening (page 251.) | 550 parts |
| | 200 „ | Sodium Chlorate, | 150 „ |
| | 200 „ | China clay 1:1, | 300 „ |
| | 50 „ | Yellow Prussiate of Potash, | 1000 parts. |
| { | 100 „ | Citric acid, | |
| | 75 „ | Water, | |
| 1000 parts. | | | |

For Basic colours, Mordant colours, Indigo, Thiogene colours (in light shades).

| Chlorate Discharge 8. | | Thickening for Reductions. | |
|-----------------------|--|-----------------------------|-----------------------|
| I { | 80 parts | Wheat starch, | |
| | 480 „ | Water, | |
| | 190 „ | Sodium Chlorate, | 90 parts |
| | Boiled, then cooled to 113° F., and added, | | starch, } boiled, |
| II { | 50 „ | Yellow Prussiate of Potash, | 910 „ |
| | 50 „ | Tartaric acid, | Water, } then cooled. |
| | 50 „ | Citric acid, | |
| | 100 „ | Water, | |
| 1000 parts. | | 1000 parts. | |

For Indigo.

TABLE SHEWING THE DISCHARGEABLE QUALITIES OF COTTON COLOURS.

1. Colours discharged to a pure white, even in dark shades.
2. Colours discharged white in light shades.
3. Colours, not discharged white, but suitable for light, bright coloured discharges.
4. Colours not discharged white, suitable only for dark coloured discharges.
5. Colours not discharged at all, and therefore suitable for additions to coloured discharge-pastes

| Colour | Chlor-ate | Tin | Sulphite | Hydro-sulphite |
|--|-----------|-----|----------|----------------|
| Methylene Yellow H | 1 | 5 | 5 | 5 |
| Auramine conc., O, I, II | 1 | 5 | 4-5 | 4-5 |
| Auroflavine KR | 1 | 5 | 4-5 | 4-5 |
| Flavophosphine 4G conc. new, 2G conc. new, G conc. new | 2 | 5 | 5 | 5 |
| Flavophosphine R conc. new | 2 | 5 | 5 | 5 |
| Phosphine O, extra | 2-1 | 5 | 4-5 | 4 |
| Azophosphine GO, BRO | 1 | 2-3 | 3-4 | 3 |
| Leather Yellow Base 3R, O, OB | 2-1 | 5 | 4-5 | 4-5 |
| Vesuvine conc. 2G, 4BG | 2 | 2-3 | 4 | 2 |
| Rosazeine, all brands | 2 | 5 | 5 | 5-4 |
| Rosazeine Scarlet G extra | 1-2 | 4-5 | 4-5 | 1-2 |
| Safranine, all brands | 2-1 | 5 | 5 | 3-4 |
| New Magenta O | 1 | 5 | 4 | 2-3 |
| Magenta, all brands | 1 | 5 | 4 | 2-3 |
| Grenadine, Cerise | 2-3 | 5 | 4-5 | 3-4 |
| Methylene Violet, all brands | 2-1 | 5 | 5 | 4-5 |
| Methylene Heliotrope O | 2-1 | 5 | 5 | 4-5 |
| Methyl Violet R to 5R | 1 | 5 | 4-5 | 4-5 |
| Methyl Violet B to 6B, 7B superior, 8B superior | 1 | 5 | 5 | 3-4 |
| Violet Crystals O | 1 | 5 | 5 | 3-4 |
| Marine Blue, all brands | 2 | 5 | 5-4 | 3-4 |
| Discharge Marine Blue S extra conc. | 4 | 5 | 4-5 | 5 |
| Victoria Blue R, 4R, B | 1 | 5 | 5 | 3-2 |
| Methylene Blue, all brands | 2-3 | 5-4 | 2-3 | 5-4 |
| New Methylene Blue N | 2-3 | 5-4 | 2-3 | 5-4 |
| Thionine Blue | 2-3 | 5-4 | 2-3 | 5-4 |
| Ethyl Blue RD, BD | 2 | 5 | 5 | 5-4 |
| New Ethyl Blue RS, BS, R, B | 2-3 | 5 | 5 | 5-4 |
| Diphen Blue R conc. | 2-3 | 5 | 5 | 5-4 |
| Fast Cotton Blue 3R, R extra, TA I | 2-3 | 4-5 | 4 | 4 |
| Fast Blue for Cotton TA II, TAIV | 2-3 | 4-5 | 4-5 | 4-5 |
| New Fast Blue 3R crystals | 4-5 | 4-5 | 4-5 | 4-5 |
| Methylene Grey BD, ND, O | 1-2 | 5 | 4-5 | 4-5 |
| Brilliant Green crystals extra | 1 | 5 | 2-3 | 2-1 |
| Malachite Green crystals extra | 1 | 5 | 2-3 | 2-1 |

| Colour | Chlor-ate | Tin | Sulphite | Hydro-sulphite |
|--|-----------|-----|----------|----------------|
| Methylene Green, all brands | 2 | 4-5 | 2-3 | 3-4 |
| Janus Yellow G | 2 | 4-3 | 5-4 | 4-5 |
| Janus Yellow R | 2-3 | 3 | 5-4 | 4-5 |
| Janus Red B | 2 | 2 | 5-4 | 2-3 |
| Janus Brown R | 2 | 4-3 | 5-4 | 1-2 |
| Janus Blue G | 1-2 | 4 | 4 | 5 |
| Janus Blue B | 2-1 | 4 | 4 | 5 |
| Indophene Blue AE | 1-2 | 4 | 4 | 4 |
| Alizarine Yellow 5G powder | 4-5 | 4 | 5-4 | 2 |
| Mordant Yellow O | 3 | 1-2 | 4 | 1 |
| Alizarine Yellow GG paste | 4-5 | 4 | 5-4 | 2 |
| Alizarine Yellow KR | 4-5 | 4 | 4-5 | 2 |
| Alizarine Yellow R paste | 4 | 3 | 4 | 2-1 |
| Alizarine Orange paste (Alumina) | 4-5 | 4-5 | 5 | 4-5 |
| Alizarine Orange paste (Chrome) | 2-3 | 4-5 | 5 | 5-4 |
| Alizarine Red, all brands (Alumina) | 3 | 5 | 5 | 5 |
| Alizarine Red, all brands (Chrome) | 3 | 4-5 | 5 | 4 |
| Alizarine Claret R paste (Alumina) | 2 | 4-5 | 5 | 5 |
| Alizarine Blue SB pdr., SR pdr., S2R paste, SRX paste | 2-1 | 5-4 | 5 | 5 |
| Philochromine B paste | 1 | 5 | 4 | 4 |
| Philochromine G paste | 1 | 5 | 4 | 4-5 |
| Chrome Violet VM, BMJ | 1 | 5 | 4 | 5 |
| Alizarine Green S paste | 2 | 5 | 5-4 | 5 |
| Ceruleine SW paste | 2 | 5 | 4-5 | 4-5 |
| Alizarine Brown paste | 2 | 5-4 | 5 | 5 |
| Solid Green O 50% paste (Iron) | 5-4 | 4 | 4 | 4 |
| Solid Green O 50% paste (Alkaline Copper) | 3 | 4-5 | 5-4 | 4-5 |
| Dianil Yellow 3G | 5 | 3 | 5 | 3 |
| Dianil Yellow G | 3-4 | 4-5 | 5 | 3-4 |
| Dianil Yellow R | 5-4 | 1-2 | 5 | 3 |
| Dianil Yellow 2R | 1-2 | 5 | 5-4 | 3 |
| Dianil Pure Yellow HS | 5 | 4 | 5 | 5 |
| Oxydianil Yellow G, O | 4 | 5 | 5 | 5 |
| Cresotine Yellow G | 2 | 1-2 | 5 | 1 |
| Aurophenine O | 1-2 | 4 | 5 | 1 |
| Dianil Direct Yellow S | 5 | 3-4 | 5 | 4 |
| Dianil Orange G | 2 | 1-2 | 5-4 | 3-4 |
| Dianil Orange N | 2 | 1-2 | 5 | 2 |
| " " (aftertreated with Azophor Red) | 4 | 2-3 | 5 | 2 |
| Toluylene Orange R | 4-5 | 4-5 | 5 | 1-2 |
| " " (aftertreated with Azo- phor Red) | 4-5 | 3 | 5 | 3 |
| Dianil Brown 3GO | 2-3 | 3-4 | 5-4 | 2 |
| " " (aftertreated with Azo- phor Red) | 3-4 | 2-3 | 5 | 1 |

| Colour | Chlor-ate | Tin | Sulphite | Hydro-sulphite |
|---|-----------|-----|----------|----------------|
| Dianil Brown 3GO (aftertreated with Bichrome and Copper Sulphate) | 2-3 | 3-4 | 5-4 | 2 |
| Dianil Brown 5G | 3-4 | 2 | 5-4 | 3 |
| " " (aftertreated with Azophor Red) | 3-4 | 2 | 5-4 | 2-3 |
| Dianil Brown X | 1-2 | 2 | 4-5 | 1 |
| Dianil Brown 2G | 2-3 | 2-3 | 5-4 | 1 |
| " " (aftertreated with Azophor Red) | 3-4 | 2 | 5-4 | 1 |
| Dianil Japonine G | 2 | 2 | 4-5 | 1 |
| " " (aftertreated with Copper Sulphate) | 1-2 | 3 | 4-5 | 1-2 |
| " " (aftertreated with Bichrome and Copper Sulphate) | 1-2 | 3 | 4-5 | 1 |
| Dianil Brown 3R | 2 | 2 | 4-5 | 1 |
| Dianil Brown R | 2 | 2 | 5 | 1 |
| " " (aftertreated with Azophor Red) | 2 | 2-3 | 5 | 1 |
| Dianil Brown MH | 2 | 2-3 | 5 | 1 |
| " " (aftertreated with Bichrome and Copper Sulphate) | 2-3 | 3-4 | 5 | 1-2 |
| " " (diazotised and developed with m-Phenylene Diamine) | 2 | 3 | 5 | 1 |
| Dianil Chrome Brown R | 4 | 1 | 5 | 1 |
| " " (aftertreated with Bichrome and Copper Sulphate) | 4 | 1-2 | 5 | 1-2 |
| Dianil Brown G | 2-3 | 2-3 | 5-4 | 1 |
| Dianil Brown M | 2-3 | 2-3 | 5-4 | 1 |
| " " (aftertreated with Azophor Red) | 3-4 | 3 | 5-4 | 1 |
| Dianil Fast Brown R | 3-4 | 3-4 | 5-4 | 1-2 |
| " " (aftertreated with Copper Sulphate) | 2-3 | 3-4 | 5-4 | 1-2 |
| Dianil Fast Brown B | 3-4 | 3-4 | 5-4 | 1 |
| " " (aftertreated with Copper Sulphate) | 3-4 | 3-4 | 5-4 | 1 |
| Dianil Brown A (No. 8611) | 1-2 | 1 | 5-4 | 1 |
| Dianil Brown BD | 3-4 | 3 | 5 | 1 |
| " " (aftertreated with Azophor Red) | 3-4 | 3 | 5 | 1 |
| Dianil Brown B | 2 | 3 | 4-5 | 1 |
| " " (aftertreated with Azophor Red) | 3 | 3 | 4-5 | 1 |

| Colour | Chlor-ate | Tin | Sulphite | Hydro-sulphite |
|---|-----------|-----|----------|----------------|
| Dianil Brown D | 2 | 3 | 4-5 | 1 |
| " " (aftertreated with Azo-phor Red) | 3 | 3 | 5-4 | 1 |
| Dianil Red 4B | 1 | 2-3 | 5 | 2 |
| Dianil Red R | 1 | 1-2 | 5 | 2 |
| Delta Purpurine 5B | 1-2 | 1 | 5 | 2-3 |
| Dianil Scarlet 2R | 2-3 | 2 | 4-5 | 1 |
| " " (aftertreated with Solidogen) | 2-3 | 2 | 5-4 | 1 |
| Dianil Red 10B | 1 | 1-2 | 5 | 1 |
| Brilliant Dianil Red R | 1-2 | 1 | 5 | 2 |
| Dianil Pink BD | 1-2 | 2 | 4-5 | 1 |
| Dianil Fast Scarlet 8BS | 2 | 1 | 5 | 1 |
| Dianil Fast Red PH | 4 | 2 | 5 | 1 |
| " " (aftertreated with Chrome-Alum) | 4 | 4 | 5 | 1 |
| Dianil Crimson G, B | 4 | 4 | 5 | 2 |
| Dianil Claret Red G, B | 1-2 | 2-3 | 4 | 1-2 |
| Dianil Violet H | 3-4 | 3 | 5 | 1 |
| Dianil Blue H6G | 1-2 | 1-2 | 5 | 1 |
| Dianil Blue H3G, H2G | 2 | 2-3 | 5 | 1 |
| Dianil Blue G | 1-2 | 1-2 | 3-4 | 1 |
| Dianil Blue B | 2 | 2 | 3-4 | 1 |
| Dianil Blue R | 1-2 | 2-3 | 3 | 1 |
| Dianil Blue 2R | 1-2 | 2 | 3-4 | 1 |
| Dianil Blue HG | 1-2 | 2 | 4 | 1 |
| Dianil Blue 3R, 4R | 2-3 | 2-3 | 4 | 1 |
| Dianil Blue BX | 2-3 | 2-3 | 3-4 | 1 |
| " " (aftertreated with Copper Sulphate) | 2-3 | 3 | 4 | 1 |
| Dianil Azurine G | 1-2 | 2 | 3 | 1 |
| " " (aftertreated with Copper Sulphate) | 1-2 | 2 | 3 | 1 |
| Dianil Indigo O | 3 | 2 | 4 | 1 |
| " " (aftertreated with Copper Sulphate) | 1-2 | 2 | 4 | 1 |
| Dianil Dark Blue R | 1-2 | 1-2 | 4-5 | 1 |
| Dianil Dark Blue 3R | 3 | 1-2 | 4-5 | 1 |
| Dianil Green B, G | 2 | 2-1 | 4 | 1-2 |
| Dianil Dark Green B | 2-3 | 3-4 | 4 | 1-2 |
| Dianil Black ES | 3-4 | 2 | 5 | 1 |
| " " (Diazotised and developed with Naphtol) | 4-5 | 2 | 5 | 1 |
| " " (diazotised and developed with Phenylene diamine) | 4-3 | 2 | 5-4 | 1 |
| Dianil Black CR | 4-3 | 2 | 5-4 | 1 |
| " " (aftertreated with Bi-chrome and Copper Sulphate) | 2-3 | 2 | 5-4 | 2 |

| Colour | Chlorate | Tin | Sulphite | Hydro-sulphite |
|---|------------|------------|------------|----------------|
| Dianil Black CR (aftertreated with Azophor Red) | 2-3 3 | 3 2 | 5-4 5-4 | 1 1 |
| Dianil Black CB ,, ,, (aftertreated with Bichrome and Copper Sulphate) | 2-3 4 | 2-3 2 | 4-5 4 | 2 1 |
| Dianil Black N ,, ,, (aftertreated with Bichrome and Copper Sulphate) | 3-4 3-4 | 2-3 4 | 4-5 4-5 | 1 1 |
| Patent Dianil Black FF conc. | 3 3 | 3 3 | 5-4 5-4 | 1 1 |
| Patent Dianil Black FFC conc., EF conc. | 3-4 2-3 | 2-3 2-3 | 5-4 5-4 | 1 1 |
| Patent Dianil Black FFA extra conc., RW extra | 2-3 3 | 2 2 | 4-5 5-4 | 1 1 |
| Patent Dianil Black EB conc., FB | 3 2 | 2 5 | 5-4 5 | 1 5 |
| Thiogene Golden Yellow AO | 2 2 | 5 5 | 5 5 | 5 5 |
| Thiogene Yellow GG | 1-2 1-2 | 5 5 | 5 5 | 5 5 |
| Thiogene Yellow G | 2 3 | 5 5 | 5 5 | 5 5 |
| Thiogene Orange OG | 2 2 | 5 5 | 5 5 | 5 5 |
| Thiogene Orange RG | 3 2 | 5 5 | 5 5 | 5 5 |
| Thiogene Orange R | 2 2 | 5 5 | 5 5 | 5 5 |
| Thiogene Orange RR | 2 2 | 5 5 | 5 5 | 5 5 |
| Thiogene Brown GC | 1-2 3 | 5 5 | 5 5 | 5 5 |
| Thiogene Khaki O | 2-3 3-4 | 5 5 | 5 5 | 5 5 |
| Thiogene Brown GR | 3-4 3-4 | 5 5 | 5 5 | 5 5 |
| Thiogene Brown GRR | 3-4 3-4 | 5 5 | 5 5 | 5 5 |
| Thiogene Brown R | 3-4 2 | 5 5 | 5 5 | 5 5 |
| Thiogene Brown RR | 1 1 | 5 5 | 5 5 | 4-5 5-4 |
| Thiogene Brown S | 1 1 | 5 5 | 5 5 | 4-5 5-4 |
| Thiogene Catechu R | 1 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Dark Red G, R | 1 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Rubine O | 1 1 | 5 5 | 5 5 | 5 5 |
| ,, ,, (aftertreated with Copper Sulphate) | 1 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Heliotrope O | 1 1 | 5-4 5 | 5 5 | 4-5 4-5 |
| Thiogene Violet B, V | 1 1 | 5 5 | 5 5 | 4-5 5 |
| Thiogene Cyanine G, O | 1-2 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Blue | 1 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Dark Blue BL, BTL | 1 1 | 5 5 | 5 5 | 5 5 |
| Melanogen Blue BG, B (Fixing Salt) | 1 1 | 5 5 | 5 5 | 5 5 |
| Melanogen Blue BG, B (Copper Sulphate) | 1 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Green B | 2 1 | 5 5 | 5 5 | 5 5 |
| Thiogene Green GG | 1 2-3 | 5 5 | 5 5 | 5 5 |
| Thiogene Green BL extra, GL extra | 2-3 5 | 5 5 | 5 5 | 5 5 |
| Thiogene Black | 2-3 5 | 5 5 | 5 5 | 5 5 |

COTTON YARN PRINTING.

I. Preparation of the Yarn.

Boiling. The raw yarn is first boiled, preferably under a pressure of $1\text{--}1\frac{1}{2}$ atmosphere, for 3 to 4 hours in water with a slight addition of Soda ash. The addition of Soap or the use of strong Soda or Caustic Alkali is not permissible, as the colour ultimately obtained in printing is then liable to run and bleed. A thorough washing after boiling is necessary for the production of sharp prints.

Chemicking. When necessary, the yarns are slightly chemicked after boiling. The chemicking liquids should not be too strong, or inferior colours will result.

Sizing. When using colours which bleed readily the yarn should be sized or starched, before printing. The sizing liquor should not contain Tallow or Soap. Warp yarns, which, after printing are not steamed and do not undergo any further operations but require to have a certain amount of stiffness in order to be worked properly during weaving, obtain a better appearance if previously starched.

Dyeing. When dyeing yarns to be subsequently printed with Direct colours, the use of Soap or Soda is inadmissible. The use of Turkey Red oil and other fatty acids is only permissible when the printing colour requires an oil preparation for its proper fixation. On the other hand the addition of Common Salt, Glauber's salt, and Phosphate of Soda to the dye-bath is beneficial. For discharge colours with Hydrosulphite NF conc., Soda may be used during dyeing.

An aftertreatment with Copper Sulphate is not suitable for yarns printed with steam colours, owing to the liability of Copper salts to tender the yarn during steaming.

Dyeing with Basic, Mordant and Azo colouring matters is carried out according to the usual methods. The oil which is used in the dyeing of the latter two classes of colours must be reduced to a minimum, and the yarn after dyeing, thoroughly washed with hot water to free it from the superfluous oil.

When printing upon Para Red, the yarns are chemicked only after dyeing.

Topping. Printed yarns are sometimes topped. The colours suitable for this purpose are: Alizarine Yellow 5G powder, GG paste, Alizarine Orange paste, Alizarine Brown paste, Alizarine Red all brands, Alizarine Blue SB, SR powder, Chrome Blue, Chrome Violet. Philochromine B and G paste, Ceruleine all brands, Alizarine Green S paste, Diphenyl Black Base I, Paranitriline Red,

II. Thickenings used for Yarn Dyeing.

The following thickenings are applicable to yarn printing:

| | |
|---------------|-----------------|
| Wheat Starch, | British Gum, |
| Maize Starch, | Tragacanth, |
| Dextrine, | Carrageen Moss, |
| Senegal Gum. | |

The following are some recipes for thickenings for the so-called Iron machine:

Thickening I.

| | |
|-------------------------------|--|
| 2 lbs. 14 1/2 ozs. (2900 grs) | Wheat starch, |
| 4 ,, (4000 ,,) | Tragacanth (60:1000) are boiled for |
| | 15 minutes with |
| 21 1/2 ,, (21500 ,,) | Water, being continually well stirred |
| | and |
| 1 ,, 9 1/2 ozs. (1600 ,,) | Acetic acid 50% are added immediately after boiling. |
| 30 lbs. (30 ko.) | |

The thickening is then cooled and strained.

Thickening II.

| | |
|---------------------|---------------------------------------|
| 2 1/2 lbs (2500 gr) | Wheat starch, |
| 5 1/2 ,, (5500 ,,) | Tragacanth (60:1000) and |
| 22 ,, (22000 ,,) | Water are well boiled for 1/2 an hour |
| 30 lbs (30 ko.) | |

The thickening is then cooled and strained.

Thickening III.

| | |
|-------------------------------|--------------------------------------|
| 2 lbs. 14 1/2 ozs. (2900 gr) | Wheat starch, |
| 4 ,, (4000 ,,) | Tragacanth (60:1000) are well boiled |
| | for 10 minutes with: |
| 21 ,, 3 1/4 ,, (21200 ,,) | Water, then are added |
| 5 ,, (300 ,,) | Olive oil and |
| 1 ,, 9 1/2 ,, (1600 ,,) | Acetic acid 50% |
| 30 lbs. (30 ko.) | |

The thickening is then cooled and strained.

Thickening IV.

| | |
|-----------------------------|---|
| 4 lbs. 13 ozs. (4800 gr) | Wheat starch, |
| 3 ,, 9 1/2 ,, (3600 ,,) | Acetic acid 50% |
| 21 ,, 9 1/2 ,, (21600 ,,) | Water are boiled together for 1/4 of an |
| | hour and cooled whilst being stirred, |
| | and afterwards diluted to |
| 30 lbs. (30 ko.) | |

When printing Alizarine Red, a small quantity of Turkey Red oil is added to Thickening III after cooling.

III. Mordants used in Yarn Printing.

In yarn printing the following mordants are used:

| | |
|---------------------------|--------------------|
| Acetate of Alumina, | Acetate of Chrome, |
| Nitro Acetate of Alumina. | Acetate of Tin, |
| Nitrate of Alumina, | Oxalate of Tin, |
| Tartrate of Alumina, | Acetate of Iron. |
| Sulphocyanide of Alumina, | Acetate of Lime. |

IV. Yarn Printing Machines.

Yarns are printed either in the hank or warp form, and consequently various types of machines are used for the purpose. The types most generally used are:

I. Machine for hanks.

(A). Single colour printing machines

1. Iron or English machines.
2. Wooden machines or Bohemian mangles.

(B). Multi-colour printing machines.

3. Iron multi-colour printing machines
4. Wooden multi-colour printing machines or Bohemian mangles.

II. Machines for single threads or warps.

5. Thread printing machines.
6. Warp printing machines.

V. The printing of yarns.

The various operations connected with the printing of yarns may be divided into three stages: printing, steaming and aftertreatment.

1. Printing.

The printing of the bleached, dyed or sized yarn may be accomplished on one or other of the machines described above, fine one-colour patterns being best produced on the Iron-printing machines, heavier designs on the Bohemian mangle or multi-colour printing machines, and two or more colours on the Iron or Wooden machines.

After printing, the yarn should be dried at a medium temperature, and the colour ultimately developed and fixed by steaming.

2. Steaming.

The dried yarn is then divided into 1 lb. lots, placed on sticks, and hung in the steamer. To prevent water-drops falling on the yarn it should be covered with canvas and the steaming chest heated before the yarn is placed in it. As the steaming should be accomplished as quickly as possible and should be even and thorough, the

yarn should not be hung too closely together. To remove the gases formed during steaming, the steaming apparatus should be provided with outlets for their removal as soon as formed.

The duration and the pressure of the steaming process depends on the printing colour.

3. Methods of Aftertreatment.

Printed yarns, after steaming, require in most cases, an after-treatment, either to fix the colouring matter, neutralise the acids formed, do away with the superfluous thickenings, or to clear the white. The aftertreatment, therefore may take various forms.

a) Fixation with Antimony Compounds.

This method is employed when the yarn, has been printed with Tannin dyestuffs. The yarn is treated for $\frac{1}{4}$ — $\frac{1}{2}$ an hour at 86—122° F., in a bath containing 1 to 5 parts Tartar Emetic per 1000 parts of liquid; it is then wrung out and allowed to lie for a short time and finally well washed.

b) Chalk Bath.

When Mordant dyestuffs have been used in printing, the free acids formed during steaming must be neutralised and the colour lake fixed on the yarn by treating it for a short time in a warm bath containing 6 to 10 parts of Calcium Carbonate per 1000 parts.

c) Aftertreatment with Bichromate of Potash, Soda or Lime.

Aniline Black is treated with either 3 to 4% Bichromate of Potash or 5% Soda or Lime. The Oxazine dyestuffs may be developed with Bichromate of Potash.

d) Soaping.

Soaping is necessary to increase the brilliancy of Alizarine Reds, it also brightens the Mordant colours which have been fixed with Chalk.

e) Malting.

This operation effects the removal from the yarn of the starch thickenings which have been used in printing, by converting the starch into soluble diastase. For this purpose fresh Malt or one or the other of the diastase containing commercial products should be used. The yarn should be treated for $\frac{1}{4}$ — $\frac{1}{2}$ an hour at 86—122° F. in a bath containing 20 to 50 parts of Malt per 1000 parts of water (calculated on the weight of the yarn), and finally well washed.

f) Chemicking.

The treatment of printed yarns in a weak Chlorine bath is frequently necessary for the improvement of the white.

VI. METHODS OF PRINTING.

The following styles are used in yarn printing:

1. Steam-colours.
2. Colours produced on the fibre by oxidation.
3. Insoluble Azo-colours produced on the fibre.
4. Discharge Effects.

1. Steam Colour Printing.

a) Substantive or Direct colours (Dianil dyestuffs).

The Dianil colours can be printed, on the Iron machine, according to the following recipe:

| | | | |
|--------|-----------|----------|--------------------|
| | 3 1/2 oz. | (220 g) | Dyestuff, |
| 8 lbs. | 6 3/4 „ | (8430 g) | Water, |
| | 13 „ | (800 g) | Wheat starch, |
| | 3 1/2 „ | (220 g) | Phosphate of Soda, |
| | 1 1/4 „ | (110 g) | Glycerine, |
| | 3 1/2 „ | (220 g) | Turkey Red oil, |
| | 10 lbs. | (10 ko.) | |

After printing, the yarn is steamed for 1 1/2 hours with steam which is not too dry.

b) Basic Colours.

The Basic dyestuffs may be printed with only slight alterations according to the following recipes:

| 1. | 2. |
|-------------------------------|-------------------------------|
| 1 1/2 oz. (10 g) Dyestuff, | 1 1/2 oz. (10 g) Dyestuff |
| 4 „ (25 g) Acetic acid | Base), |
| 50%, | 8 „ (50 g) Acetic acid |
| 1 1/2 „ (10 g) Acetine, | 50%, |
| 4 lbs. 2 1/2 „ (414 g) Water, | 1 1/2 „ (10 g) Acetine, |
| 5 „ (500 g) Thickening I, | 1/2 „ (3 g) Tartaric |
| 1/4 „ (1 g) Tartaric | acid, |
| acid, | 2 1/2 „ (15 g) Glycerine, |
| 6 1/2 „ (40 g) Acetic acid | 5 lbs (500 g) Thickening I, |
| tannin solu- | 6 1/2 „ (40 g) Acetic acid |
| tion 1:1 | tannin solu- |
| 10 lbs. (1 kilo). | tion 1:1, |
| | 3 lbs. 12 1/2 „ (372 g) Water |
| | 10 lbs. (1 kilo). |

Steaming from 1—1 1/2 hours follows the printing operation. During the steaming, the formation of the lake and the fixation of the colouring matter within the fibre takes place. In the succeeding treatment with Tartar Emetic the printed colours are made fast to water and to soap; finally the yarns are washed.

The Basic colours are either Salts or free colour Bases. In preparing printing colours containing the latter, an addition of an

organic acid may be made in order to effect solution (recipe 2). The following are dyestuff bases: Ethyl Blue RD, BD, New Ethyl Blue R and B, Leather Yellow Base 3G, O, and OB.

c) Printing with Mordant Colours.

A number of Mordant colours are printed on previously oiled yarn, (30—50 parts Sodium Turkey Red oil per 1000 for dry yarn, and 50—70 parts per 1000 for wetted yarns). If the oiling bath is too concentrated, the resulting white is yellowish in colour, unless the yarn is washed and soaped immediately after steaming.

The yarns are soaped in a warm bath (68° F.) containing 1% Olive oil soap; rinsed in clear water, and again worked in a fresh soap bath of the same concentration, at 140—212° F.; finally they are well rinsed.

The following are recipes for yarn printing with Mordant colours on the iron multi-colour printing machine.

| | |
|--|--|
| <p>1. Aliz. Yellow 5G pdr. 5lbs. 8 oz. (5500g) Thickening II, 1½ „ (100g) Aliz. Yellow 5G pdr. 3lbs. 12 „ (3750g) Water, 2½ „ (150g) Glycerine, 8 „ (500g) Acetate of Chrome 32° Tw. 10 lbs. (10 kilos).</p> | <p>2. Aliz. Yellow GG paste. 5lbs. 8 oz. (5500g) Thickening II, 11 „ (700g) Aliz. Yellow GG paste, 3lbs. 4 „ (3250g) Water, 8½ „ (550g) Acetate of Chrome 32° Tw. 10 lbs. (10 kilos).</p> |
| <p>3. Alizarine Orange with Alumina. 5lbs. 8 oz. (5500g) Thickening III, 1 „ (1000g) Aliz. Orange paste 20%, 6½ „ (400g) Acetic acid 50%, 1 „ 7¼ „ (1450g) Water, 8¾ „ (550g) Acetate of Lime 15° Tw., 1 „ 1½ „ (1100g) Acetate of Alumina 18° Tw. 10 lbs. (10 kilos).</p> | <p>4. Alizarine Orange with Chrome. 5lbs. 8 oz. (5500g) Thickening II, 1 „ (1000g) Aliz. Orange paste 20%, 6½ „ (400g) Acetic acid 50%, 2 „ 6 „ (2375g) Water, 11½ „ (725g) Acetate of Chrome 32° Tw. 10 lbs. (10 kilos).</p> |
| <p>5. Aliz Red with Chrome. 6lbs. (6000g) Thickening II, 9½ oz. (600g) Aliz. No. 1 paste 20%, 2 „ 12 „ (2750g) Water, 6½ „ (400g) Acetate of Chrome 32° Tw. 4 „ (250g) Acetate of Lime 15° Tw. 10 lbs. (10 kilos).</p> | <p>6. Alizarine Lilac. 6lbs. (6000g) Thickening II, 4 oz. (250g) Al. Red No. 1 paste 20%, 3¼ „ (200g) Acetic acid 50%, 3 „ 2¼ „ (3135g) Water, 4 „ (250g) Acetate of Lime 15° Tw., 2½ „ (165g) Pyrolignite of iron 15° Tw. 10 lbs. (10 kilos).</p> |

| 7. | 8. |
|--|---|
| Alizarine Red with Alumina (on oiled yarn). | Alizarine Pink (on oiled yarn). |
| 6 lbs. (6000 g) Thickening III, 6 1/2 oz. (400 g) Aliz. Red 5F 20% paste, 3 1/4 ,, (200 g) Acetic acid 50%, 2 ,, 6 ,, (2415 g) Water, 5 1/4 ,, (320 g) Acetate of Lime 15° Tw., 7 1/4 ,, (440 g) Aluminium Acetate 18° Tw., 3 3/4 ,, (225 g) Oxalate of Tin 25° Tw. | 6 lbs. (6000 g) Thickening III, 2 oz. (125 g) Aliz. Red IB paste 20%, 3 1/4 ,, (200 g) Acetic acid 50%, 3 ,, 5 1/2 ,, (3330 g) Water, 2 1/2 ,, (160 g) Acetate of Lime 15° Tw., 2 3/4 ,, (185 g) Aluminium Acetate 18° Tw. <hr/> 10 lbs. (10 kilos). |
| 10 lbs. (10 kilos). | |

On unoled yarn Red and Pink are printed with the addition of Lizarol D conc. (See page 260.)

| 9. | 10. |
|---|--|
| Red (on unoled yarn). | Pink (on unoled yarn). |
| 2 lbs. 8 oz. (2500 g) Wheatstarch tragacanth thickening (page 251), 3 1/4 ,, (200 g) Lizarol D conc., 8 ,, (500 g) Acetic acid 50%, 6 1/2 ,, (400 g) Aliz. Red 20%, 5 ,, 7 ,, (5450 g) Water, 7 ,, (450 g) Sulphocya- nide of Alu- mina 18° Tw., 2 1/2 ,, (150 g) Acetate of Alumina 17° Tw., 3 1/4 ,, (200 g) Acetate of Lime 23° Tw., 3/4 ,, (50 g) Oxalate of Tin 25° Tw., 1 3/4 ,, (100 g) Tartaric acid 1:10, | 2 lbs. 8 oz. (2500 g) Wheatstarch tragacanth thickening, 2 1/2 ,, (150 g) Lizarol D conc., 4 ,, (250 g) Acetic acid 50%, 1 3/4 ,, (100 g) Alizarine DIB new 20%, 6 ,, 10 ,, (6650 g) Water, 5 ,, (300 g) Sulphocya- nide of Alu- mina 18° Tw., 3/4 ,, (50 g) Acetate of Lime 28° Tw., <hr/> 10 lbs. (10 kilos). |
| 10 lbs. (10 kilos). | |

11.
Alizarine Claret R with
Alumina
5lbs. 8 oz. (5500 g) Thickening
III,
1 ,, (1000 g) Alizarine Cla-
ret R paste.
4 ,, (250 g) Acetic acid
50^o/₁₀₀,
1 ,, 13 ,, (1810 g) Water,
10 ,, (640 g) Acetate of
Lime 15^o Tw.,
13 ,, (800 g) Acetate of
Alumina 18^o Tw.
10 lbs. (10 kilos).

13.
Alizarine Blue.
5lbs. 8 oz. (5500 g) Thickening II,
5¹/₄ ,, (330 g) Aliz. Blue SB
pdr.
3 ,, 13¹/₂ ,, (3340 g) Water,
5¹/₄ ,, (330 g) Acetate of
Chrome 32^o Tw.
10 lbs. (10 kilos).

15.
Alizarine Green.
5lbs. 8 oz. (5500 g) Thickening II,
1 ,, (1000 g) Aliz. Green S
paste,
7¹/₂ ,, (465 g) Bisulphite of
Chrome 32^o Tw.,
1³/₄ ,, (115 g) Bisulphite of
Nickel 32^o Tw.,
2 ,, 14³/₄ ,, (2920 g) Water
10 lbs. (10 kilos).

17.
Philochromine.
6lbs. (6000 g) Thickening II,
1 ,, (1000 g) Philochrom-
ine B paste,
2¹/₂ oz. (150 g) Formic acid
95^o/₁₀₀,
2 ,, 9¹/₂ ,, (2600 g) Water,
4 ,, (250 g) Acetate of
Chrome 32^o Tw.
10 lbs. 10 kilos.

12.
Alizarine Claret with
Chrome.
5lbs. 8 oz. (5500 g) Thickening II,
1 ,, (1000 g) Alizarine Cla-
ret R paste,
2 ,, 12 ,, (2750 g) Water,
12 ,, (750 g) Acetate of
Chrome 32^o Tw.
10 lbs. (10 kilos).

14.
Alizarine Brown.
5lbs. 8 oz. (5500 g) Thickening II,
2³/₄ ,, (170 g) Aliz. Brown R
pdr.
3 ,, 9 ,, (3560 g) Water,
2³/₄ ,, (170 g) Borax,
9¹/₂ ,, (600 g) Neutral
Chrome mordant.
10 lbs. (10 kilos).

16.
Ceruleine.
5lbs. 8 oz. (5500 g) Thickening II,
5 ,, (300 g) Ceruleine S
pdr.
3 ,, 7¹/₂ ,, (3475 g) Water,
11¹/₂ ,, (725 g) Acetate of
Chrome 32^o Tw.
10 lbs. (10 kilos).

18.
Chrome Violet.
5 oz. (300 g) Chrome
Violet VM paste
1lbs. 12¹/₂ ,, (1800 g) Water,
added to the
following cool-
ed solution:
6 ,, (6000 g) Thickening
II,
1 ,, 3¹/₄ ,, (1200 g) Water,
2¹/₂ ,, (150 g) Formic acid
93^o/₁₀₀,
8³/₄ ,, (550 g) Acetate of
Chrome 32^o Tw.
10 lbs. 10 kilos.

d) Printing with Eosine and Acid Colours.

This class of colouring matters only find application in such cases where brilliancy but no fastness to washing is required.

1. For Eosine, Erythrosine, Phloxine, Rose Bengale etc.

| | | | |
|---------|-----------|-----------|---------------------------|
| | 2 1/2 oz. | (150 g) | Eosine, |
| 3 lbs. | 6 1/2 " | (3400 g) | Water, |
| 6 " | " | (6000 g) | Thickening III, |
| | 7 " | (450 g) | Acetate of Chrome 32° Tw. |
| 10 lbs. | | 10 kilos. | |

The colour is printed on oiled or unoled yarn and steamed for 1 hour without pressure.

2. For most Acid Dyestuffs.

| | | | |
|---------|-----------|-----------|---------------------------|
| | 2 1/2 oz. | (150 g) | Scarlet, |
| 3 lbs. | 1 1/2 " | (3100 g) | Water, |
| 6 " | " | (6000 g) | Thickening II, |
| | 12 " | (750 g) | Aluminium Acetate 18° Tw. |
| 10 lbs. | | 10 kilos. | |

Printed on unoled yarn and steamed for 1 hour without pressure.

3. For Rosazeines.

| | | | |
|---------|-----------|-----------|---------------------------|
| | 2 1/2 oz. | (150 g) | Rosazeine G, |
| 3 lbs. | 4 1/2 " | (3300 g) | Water, |
| 6 " | " | (6000 g) | Thickening III, |
| | 2 1/2 " | (150 g) | Acetic acid 50%, |
| | 6 1/2 " | (400 g) | Acetate of Chrome 32° Tw. |
| 10 lbs. | | 10 kilos. | |

Printed on unoled yarn and steamed for one hour without pressure

4. For all Water soluble Rosaniline Blue sulphonic-acids.

| | | | |
|---------|-----------|-----------|------------------------------|
| | 2 1/2 oz. | (150 g) | Alkaline Blue, |
| 3 lbs. | 13 1/2 " | (3350 g) | Water, |
| 5 " | 8 " | (5500 g) | Thickening II, |
| | 4 " | (250 g) | Acid Turkey Red Oil 50%, |
| | 4 " | (250 g) | Bisulphite of Chrome 32° Tw. |
| 10 lbs. | | 10 kilos. | |

2. Colours produced on the Fibre by Oxidation.

The most important of these colouring matters are Aniline Black and Diphenyl Black.

In yarn printing, **Aniline Black** is worked according to the following methods:

| Sulphide of Copper Black. | | Vanadium Black. | |
|---------------------------|-----------------------|-----------------|-----------------------|
| 200 parts | Tragacanth (60:1000), | 200 parts | Tragacanth (60:1000), |
| 351 " | Water, | 524 " | Water, |
| 92 " | Aniline Salt, | 50 " | Aniline Oil, |
| 3 5 " | Aniline Oil, | 54 " | Hydrochloric acid |
| 23 5 " | Chlorate of Soda, | | 36° Tw., |
| 150 " | Water. | 23.5 " | Chlorate of Soda, |
| | Before use add: | 142 " | Water. |
| 30 " | Sulphide of Copper | | Before use add |
| | paste, | 6,5 " | Ammonium Vanadate |
| 150 " | Water | | (1:1000) |
| 1000 parts. | | 1000 parts. | |

| Steam Aniline Black Printing Colour. | | Prud'homme Black Bath. | |
|---|-----------------------|------------------------|-----------------------|
| 200 parts | Tragacanth (60:1000), | 40 parts | Tragacanth (60:1000), |
| 284 " | Water, | 200 " | Water, |
| 3.5 " | Aniline oil, | 5 " | Aniline oil, |
| 62.5 " | Aniline Salt, | 84 " | Aniline salt, |
| 33 5 " | Yellow Prussiate, | 54 " | Yellow Prussiate, |
| 200 " | Water, | 230 " | Water, |
| 16,5 " | Chlorate of Soda, | 30 " | Chlorate of Soda, |
| 200 " | Water | 307 " | Water |
| 1000 parts. | | 1000 parts. | |

Resists for Prud'homme Black.

| Resist I. | | Resist II. | |
|-------------|-----------------------|-------------|-------------------------|
| 200 parts | Tragacanth (60:1000), | 200 parts | Tragacanth (60:1000). |
| 560 " | Water, | 300 " | Water, |
| 200 " | Precipitated Chalk, | 100 " | Acetate of Soda cryst., |
| 40 " | Soda ash | 200 " | Oxide of Zinc 1:1, |
| 1000 parts. | | 200 " | Hydrosulphite NF |
| | | | conc. 1:10 |
| | | 1000 parts. | |

Resist II is used if the yarn has become too dark through prolonged drying or some other reason.

Coloured Resist.

| | |
|-------------|-----------------------------|
| 10—20 parts | Basic dyestuff, |
| 320—310 " | Water, |
| 300 " | Senegal gum 1:1, |
| 150 " | China clay 1:1, |
| 120 " | Acetate of Zinc |
| 100 " | Hydrosulphite NF conc. 1:10 |
| 1000 parts. | |

Diphenyl Black Base is worked in the following manner:

The yarn for printing should be thoroughly dried and for designs which do not give sharp prints the yarn should be warmed just before printing. A preliminary passage through 1 part of Ammonia to 1000 parts of water is beneficial, the yarn being allowed to lie in the bath for 2 hours, after which it is washed at 104° F. Sizing the yarn with 2 lbs. Wheat starch and 1 lb. Dextrine to 20 gallons of water prevents the colour from running, and bleeding. After the colour has been printed the yarn should be hung in a warm drying chamber until the black is thoroughly developed, the usual period being overnight.

The printing colours are made up as follows:

| | | For single colours on Iron Machines. | For Multi- colours on Iron Machines. | For Wooden Machines. |
|----|---|---|---|----------------------------|
| | Diphenyl Black Base I are dissolved hot in | 30 | 30 | 30 parts |
| | Acetic acid 50%, . . | 85 | 85 | 85 " |
| | Lactic acid 50% and are then added after cooling to | 40 | 40 | 40 " |
| A. | Thickening IV | 240 | — | — " |
| | Tragacanth (60:1000) . | 100 | 100 | — " |
| | Thickening of Wheat starch or Burnt starch | — | — | { 30 " |
| | Water | — | 245 | { 350 " |
| | Aluminium Chloride 52° Tw. | 17.5 | 17.5 | 17.5 " |
| | Copper Chloride 76° Tw. are added to | 2.8 | 2.8 | 2.8 " |
| | Thickening IV | 240 | — | — " |
| B. | Tragacanth (60:1000) . | 100 | 100 | — " |
| | Cold water | — | 255 | 320 " |
| | to which is added the cooled solution of | | | |
| | { Chlorate of Soda . . | 25 | 25 | 25 " |
| | { Water | 120 | 100 | 100 " |
| | | 1000 | 1000 | 1000 parts. |

Standard Colour A and B are mixed together before use.

3. Insoluble Azo Colours produced on the Fibre.

Of this class of colouring matters those mostly used are Azophor Orange MN, Azophor Pink A, Azo Pink BB, Paranitriline Red, Azophor Red PN, Alpha Naphtylamine Claret, Azophor Blue D, Azophor Black S and DP. The Azophor colours, owing to their being stable, are particularly useful for the printing of yarns.

A slight addition of Gum tragacanth thickening or starch to the Naphtol prepare improves the sharpness and clearness of the printed effects.

In order to obtain a pure white it is necessary to use a freshly prepared and clear Naphtol solution. Vessels and utensils which are used for dyeing, ought to be avoided, as they are liable to produce a reddish tinge upon the white. Moreover, the liability of the Naphtol prepare to turn brown by exposure to the air should be averted by the addition of an alkaline solution of Antimony Oxide containing Glycerine. The addition of Glucose improves the white on washing and soaping.

1. Azophor Red.

Naphtol Prepare (See page 159).

Printing Colour:

| | |
|-------------|--|
| 80 parts | Azophor Red PN are dissolved in |
| 300 " | Cold water, left to stand for $\frac{1}{2}$ an hour, filtered, and the filtered liquid slowly mixed with |
| { 42.5 " | Caustic soda 38° Tw. and diluted with |
| { 77.5 " | Cold water; |
| 500 parts. | This solution is then mixed with |
| 500 " | Thickening II. |
| 1000 parts. | |

2. Azophor Orange.

Printed according to the same recipe as Azophor Red.

3. Alpha Naphtylamine Claret.

Naphtol Prepare (See page 159).

Printing Colour:

| | |
|-------------|---|
| 23 parts | Alpha Naphtylamine Salt S powder are made into a paste with |
| 166 " | Water, to which are added |
| 12 " | Sulphuric acid 169° F. and |
| 60 " | Ice. Then a solution of |
| 9 " | Nitrite, dissolved in |
| 30 " | Cold water is slowly added at 41° F., filtered., and |
| 600 " | Thickening II, |
| { 40 " | Acetate of Soda, |
| { 60 " | Water, slowly added. |
| 1000 parts. | |

| | | | |
|--------------------|--|--------------------|-------------------------------------|
| 4. Azophor Pink A. | | 5. Azophor Blue D. | |
| Naphtol Prepare. | | Naphtol Prepare. | |
| 100 parts | Beta Naphtol, | 250 parts | Beta Naphtol, |
| 300 „ | Caustic soda 36° Tw., | 500 „ | Caustic soda 36° Tw., |
| 150 „ | Para Soap PN. | 1000 „ | Ricinoleate of Ammonia, |
| 10000 parts. | | 150 „ | Acetate of Soda cryst. |
| Printing Colour. | | 10000 parts. | |
| 20 parts | Azophor Pink A are dissolved in | Printing Colour. | |
| 400 „ | Cold water, left to stand for 1½ an hour, filtered, and the filtered liquid mixed with | 18 parts | Azophor Blue D dissolved in |
| 32 „ | Acetic acid 50%; then diluted with water to | 300 „ | Cold Water, filtered and diluted to |
| 500 parts, | to which are added | 350 parts. | This solution is mixed with |
| 400 „ | Thickening II, | 500 „ | Thickening II, to which are added |
| 15 „ | Sodium Acetate, dissolved in | 35 „ | Copper Chloride 77° Tw. and |
| 35 „ | Water and | 2 „ | Chromic acid, dissolved in |
| 50 „ | Gum Tragacanth | 113 „ | Water. |
| 1000 parts. | | 1000 parts. | |

6. Azophor Black DP.

Naphtol Prepare.

| | | |
|-----------|--------------------------|---------------|
| 250 parts | Beta Naphtol | } 10000 parts |
| 590 „ | Caustic soda 36° Tw. | |
| 1000 „ | Gum tragacanth (60:1000) | |

Printing Colour.

| | |
|-------------|-------------------------------|
| 100 parts | Azophor Black DP dissolved in |
| 340 „ | Water, |
| 500 „ | Thickening II, |
| 60 „ | Sodium Acetate. |
| 1000 parts. | |

In printing with Insoluble Azo colours, only a slight pressure should be applied. The goods must be well dried, washed and soaped hot. Azophor Red PN and Alpha Naphtylamine Claret shades are afterwards slightly chemicked in order to obtain a good white.

4. Discharge Effects.

In yarn printing, both as regards white and coloured discharges, only reducing discharges need be considered, because oxidising discharges are liable to tender the fibre.

a) Discharge Effects upon Dianil Dyestuffs.

1. Hydrosulphite Discharges.

This process is used both for white and coloured discharges, because the Dianil dyestuffs, with few exceptions, e.g. Dianil Yellow and Oxydianil Yellow, are destroyed by Hydrosulphite.

For white discharges a solution of Hydrosulphite NF conc. in Tragacanth (60 in 1000) is most suitable. The quantity of the discharging agent depends upon the depth of the colour to be discharged and on the quantity of the discharging colour applied. In order to avoid bleeding into the white in washing after steaming, it is necessary after dyeing (eventually after printing and steaming) to after-treat the yarn with 1–2% Solidogen.

The following recipe for white discharges is suitable for printing on the Iron machine:

| | |
|--------------|--|
| 50–150 parts | Hydrosulphite NF conc. are dissolved in |
| 300 | „ Tragacanth (60:1000) and |
| 450–350 | „ Water at a temperature of 104–122° F., to this are added |
| 200 | „ Zinc White 1:1 |
| <hr/> | |
| 1000 parts. | |

In order to obtain coloured discharges certain dyestuffs may be added to the Hydrosulphite White Discharge which resist the strongly reducing action of the Hydrosulphite. Such colours are:

Basic Colours. Auramine O conc., Methylene Yellow H, Flavophosphine 4G conc. new, G conc. new, R conc. new, Leather Yellow O, Rosazene 4G extra, Thionine Blue GO, Methylene Blue DBB, Discharge Navy Blue S extra conc.

Mordant Colours: Chrome Violet VM powder and paste, Chrome Blue BMJ powder and solution, Philochromine B and G paste.

Direct Colours: Oxydianil Yellow, Primuline and Dianil Pure Yellow HS.

Also Indigo.

In using Basic colours for Hydrosulphite coloured discharges the Tannin necessary for fixing the colours is added direct to the discharge colour. For dissolving the dyestuffs neither Acetic acid nor other acids may be used, as they destroy the Hydrosulphite NF conc. For that reason in order to avoid lake formation, Phenol, Acetone or Glycerine are added to the printing colours.

To fix the colours well, and at the same time to obtain the full discharge action, it is necessary to steam for a sufficiently long time. The steamed yarn is left to lie until the reduced colours are developed, and is afterwards treated with Tartar Emetic. The subsequent washing and soaping serves to develop the coloured discharges and to remove the superfluous unfixed dyestuff.

Coloured discharges for the multi-colour printing machine :

| Discharge Blue with Basic Dyestuffs. | Discharge Blue with Chrome Violet. |
|---|---------------------------------------|
| 20—30 parts Colour, | 40 parts Chrome Violet VM |
| 50 „ Glycerine, | paste are made into a |
| 10 „ Acetone dissolved | paste with |
| in | 460 „ Water and mixed into |
| 430—300 „ Water, | 200 „ Thickening II, |
| 150 „ Thickening II, | 50 „ Green Acetate of |
| 60 „ Phenol, | Chrome 32° Tw. and |
| 80—100 „ Aqueous Tannin | 250 „ Hydrosulphite NF |
| solution 1:1, | conc. 1:1 added. |
| 200—300 „ Hydrosulphite NF | 1000 parts. |
| conc. 1:1 | |
| 1000 parts. | |

For the single-colour Iron machine the printing colour must be prepared rather thicker.

2. Tin Salt Discharges.

The following Dianil colours are discharged to a pure white by Tin Salts: Cresotine Yellow G, Aurophenine, Dianil Orange N, Dianil Red 4B, R, 10B, Brilliant Dianil Red R, Dianil Claret Red G and B, Dianil Brown 3GO, 2G, BD, Dianil Blue 2R, R, B, G, Dianil Dark Blue R, Dianil Black PR and G. For coloured discharges all the Dianil colours except the Dianil Yellow and Oxydianil Yellow brands can be used.

| White Discharge for Multi-colour Printing Machine. | Coloured Discharges for Multi-colour Printing Machine. |
|--|--|
| 150 parts Gum tragacanth | 20 parts Basic dyestuff, |
| (60:1000), | 20 „ Acetic acid 50%, |
| 260 „ Water, | 330 „ Water, |
| 550 „ Acetate of Tin 32° Tw., | 200 „ Thickening IV, |
| 40 „ Citric acid. | 30 „ Tartaric acid, |
| 1000 parts. | 100 „ Acetic acid tannin |
| | solution 1:1. |
| | 300 „ Standard white. |
| | 1000 parts. |

Standard White.

| |
|--|
| 368 parts Acetate of Tin 32° Tw., |
| 148 „ British gum powder, |
| 74 „ Gum solution 1:1, |
| 37 „ Citric acid, |
| 40 „ Water. Boiled for 10 minutes, then added: |
| 222 „ Tin salts, stirred for 5 minutes; after cooling, |
| 37 „ Sodium Acetate crystals and |
| 74 „ Water are added. |
| 1000 parts. |

The printed yarn is well dried, steamed for 10–15 minutes without pressure, and aftertreated with Solidogen. For coloured discharges the yarn is passed through a Tartar Emetic bath and finally washed.

b) Discharge Effects with Basic Colours.

These are produced by discharging the Tannin ground by means of strong alkaline thickenings, and subsequent dyeing with Basic dyestuffs.

White Discharge for the Iron Printing Machine.

| | |
|-------------|-------------------------|
| 120 parts | Dextrine, |
| 120 | „ Water, |
| 200 | „ Bisulphite 66° Tw., |
| 400 | „ Caustic Soda 76° Tw., |
| 160 | „ China Clay 1:1, |
| 1000 parts. | |

Where weaker Tannin solutions are used, the Discharge colour must be reduced.

After printing, the yarn is well dried, steamed for 10 minutes without pressure, with as dry steam as possible, and passed for a short time through diluted Sulphuric acid, then well washed, and soaped for 5 minutes at 113° F. It is dyed in a weak bath with the addition of 2 lbs. Tartar Emetic and 2 lbs. Alum for every 100 lbs of yarn. After dyeing it is well washed, soaped and if necessary, chemicked.

c) Discharges of Insoluble Azo Colours produced on the Fibre.

For these, only Hydrosulphite discharges are employed; for Paranitriline Red the same recipes can be used as for Dianil colours, but if necessary, a larger quantity of Hydrosulphite is added. For Naphtylamine Claret the same recipes can be used as are employed in Calico printing, after making the corresponding alteration in the thickening.

After printing, the yarn is steamed for $\frac{1}{2}$ – $\frac{3}{4}$ of an hour, and for the coloured discharges is passed through a Tartar Emetic bath, then washed and soaped. White discharges on Naphtylamine Claret and Para Red are chemicked after soaping in order to obtain a perfectly pure white.

Linen Yarn Printing.

In order to prevent the colours from running, the bleached linen yarn is steeped in a thin solution of Starch to which Alum has been added, and then well dried.

The material so prepared is then printed after the same methods as cotton yarns.

HALF WOOL PRINTING.

The preparation of the goods for printing varies according to the class of material, whether union cloth or shoddy containing cotton.

A. Union Material (Half Wool Muslins).

Half-wool muslin print styles, as a rule, have to answer the same requirements as all-wool goods, and they are prepared in a similar manner.

1. **Scouring and Bleaching:** The pieces are freed from size and then treated in a scouring bath at 113° F. containing per 8000 gallons of Water, 16 lbs. of Soap and 24 lbs. of Solvay Soda; they are then washed and passed through a Soda solution of $\frac{2}{4}$ Tw. to completely remove the Soap. The pieces are then bleached, without washing, with Sulphurous acid by hanging them in the stoving chamber over-night, or by the continuous method; lastly they are soured in Sulphuric acid (1 part per 1000) and washed until free from acid (test by means of Congo Red solution).

2. **Chlorinating.** The goods are passed at full width through the chlorinating bath, which is prepared by mixing 200 parts of Water and 36 parts Chloride of Lime solution 9° Tw. with dilute Hydrochloric acid (200 parts of Water and 15 parts Hydrochloric acid 36° Tw.) They are then washed until free from acid (Congo Red test).

3. The preparation is carried out in two baths:

1st Bath. The goods are padded with a cold solution of double Chloride of Tin (4.5° Tw.), allowed to lie rolled up for two hours, then passed through a roller cistern containing the

2nd Bath prepared with 50 parts Sodium Phosphate per 1000. They are then well washed. hydro-extracted and dried.

Another preparation consists in padding the goods with a solution of Stannate of Soda (5 parts per 1000) and drying.

For printing, Basic, Direct and Acid colours are employed; Mordant colours are very seldom used, and then chiefly in combination with Basic colours.

For printing coloured grounds, instead of first dyeing the goods (as stated in the chapter on Half-wool dyeing) it is simpler to pad with Dianil colours with the addition of Sodium Phosphate, dry in the hot flue, print with the colours or discharges, and then to fix the ground colour and the print in one steaming operation. Acid colours can be added to the Dianil padding colours for the purpose of shading: Basic colours are also suitable for padding.

Padding Colours.

| Grey Padding Colour. | | Light Brown Padding ¹ Colour. | |
|-------------------------|---------------------------------|---|--------------------------------------|
| 7.5 parts | Dianil Blue G, | 33 parts | Dianil Brown R, |
| 2.5 " | Dianil Brown R, | 17 " | Dianil Yellow 2R, |
| 12.5 " | Dianil Black G, | 100 " | Phosphate of Soda, |
| 5 " | Patent Blue V, | 500 " | Tragacanth (60:1000), |
| 1 " | FastAcidVioletA2R, | | Make up to 10000 parts. |
| 100 " | Phosphate of Soda, | | |
| 500 " | Tragacanth (60:1000) | | |
| Make up to 10000 parts. | | Dark Blue Padding Colour. | |
| | | 500 parts | Dianil Blue R, |
| | | 300 " | Phosphate of Soda, |
| | | 500 " | Tragacanth (60:1000), |
| | | Make up to 10000 parts. | |
| Green Padding Colour. | | Pink Padding Colour. | |
| 50 parts | Brilliant Green crystals extra, | 10 parts | Rosazeine 6G, |
| 200 " | Alcohol, | 100 " | Acetic acid 6 ⁹ Tw., |
| 100 " | Tartaric acid, | 500 " | Tragacanth (60:1000), |
| 500 " | Tragacanth (60:1000), | 50 " | Acetic acid tannin solution 1:1 |
| 200 " | Acetic acid tannin solution 1:1 | | Make up to 10000 parts. ¹ |
| Make up to 10000 parts. | | | |

Direct Printing on Half Wool Material.

In direct printing the colours are fixed by steaming. Special attention must be paid to the degree of humidity of both goods and steam; to this end, the printed and dried pieces are placed for some time in a cool, moist atmosphere, after which they are steamed for 1 to 2 hours with moist steam, without pressure. If discharge colours have been employed at the same time, these are developed in the Mather-Platt before the steaming process.

Goods that have been printed with Basic colours are passed through a Tartar Emetic bath after steaming. This treatment may be omitted, however, if the goods have been previously prepared with Tin. After passing through the Tartar Emetic bath the pieces are washed, dried and finished.

As printing colours may be employed:

1. All Dianil Colours and the following blacks; Patent Dianil Black EB conc., ES. Half Wool Black T. Half Wool Black EBS.

2. Basic Dyestuffs, in conjunction with Tannin as the fixing agent.

With the exception of the blues, all the Dianil colours are satisfactorily fast to light on wool, and are printed with the addition of about 40—50 parts of Glycerine and 24—40 parts of Sodium Phosphate per 1000 parts.

3. Alizarine Colours fixed with Acetate of Chrome. For shading the Alizarine and Dianil colours, the following neutral wool colours may be used: Azo Yellow conc., Victoria Yellow O, Orange 2, 4, Fast Red O, Acid Violet 5BS, Neutral Violet O, Neutral Blue R, 3R, Patent Blue A, Alkaline Blue, Naphtalene Green conc., Amido Naphtol Black 4BH, Fast Acid Violet R and A2R.

Recipes for Dianil Colours.

| | |
|------------------------|-----------------------------|
| 640 parts { Colour, | 450 parts { Colour, |
| 300 „ { Water, | 30 „ { Water. |
| 30 „ British gum, | 30 „ Phosphate of Soda |
| 30 „ Glycerine, | heated until dissolved |
| 30 „ Phosphate of Soda | and then mixed with |
| 1000 parts. | 370 „ Tragacanth (60:1000), |
| | 150 „ Dark Burnt starch |
| | 1000 parts. |

For the principal shades the following combinations are recommended:

Yellow.

40 parts Aurophenine O.

Orange.

30 parts Dianil Orange G,
5 „ Orange No. 2,
5 „ Orange No. 4.

Red

30 parts Dianil Scarlet G,
5 „ Fast Red O,
5 „ Orange II

Blue

25 parts Dianil Blue G,
10 „ Neutral Blue R,
1.5 „ Neutral Violet O

Dark Green

35 parts Dianil Black G,
25 „ Dianil Blue R,
15 „ Naphtalene Green V.

Black

60 parts Half Wool Black for Printing EBS.

Recipes for Basic Colours.

Compared with the Dianil colours, the Basic colours are not very fast to light when printed on wool. The following are exceptions, however, and produce shades which are faster to light than those obtained with blue Dianil dyestuffs: Ethyl Blue, New Ethyl Blue, New Blue and Thionine Blue GO.

| Red. | | Pink. | |
|-------------|--------------------------------------|-------------|------------------------------------|
| 16 parts | Rosazeine extra, | 5 parts | Rosazeine 6GD, |
| 6 " | Auramine conc., | 70 " | Acetic acid 9° Tw., |
| 75 " | Alcohol, | 173 " | Water, |
| 173 " | Water, | 20 " | Acetine, |
| 700 " | Gum solution 1:1, | 690 " | Thickening St. T., |
| 30 " | Acetic acid tannin so- lution 1:1 | 30 " | Glycerine, |
| | | 2 " | Tartaric acid, |
| | | 10 " | Acetic acid tannin solution 1:1 |
| 1000 parts. | | 1000 parts. | |

Blue.

| | |
|-------------|---------------------------------|
| 15 parts | Ethyl Blue BD, |
| 5 " | Methylene Blue DBB conc., |
| 490 " | Water, |
| 100 " | Acetic acid 12° Tw., |
| 300 " | British gum powder, |
| 10 " | Tartaric acid, |
| 80 " | Acetic acid tannin solution 1:1 |
| 1000 parts. | |

Recipes for Mordant Colours.

| Yellow. | | Red. | |
|-------------|---------------------|-------------|----------------------|
| 100 parts | Alizarine Yellow GG | 18 parts | Alizarine Yellow KR |
| | paste, | | pdr., |
| 290 " | Water, | 249 " | Water, |
| 500 " | British gum 1:1, | 500 " | British gum 1:1, |
| 30 " | Formic acid 85%, | 8 " | Rosazeine G extra, |
| 80 " | Acetate of Chrome | 20 " | Acetic acid 12° Tw., |
| | 32° Tw. | 100 " | Water, |
| | | 20 " | Para Soap PN, |
| | | 85 " | Acetate of Chrome |
| 1000 parts. | | 1000 parts. | |

| Blue. | | Blue. | |
|-------------|---------------------|-------------|-------------------------------------|
| 50 parts | Alizarine Blue SB, | { | 42 parts Alizarine Blue SB |
| 375 " | Water, | | powder, |
| 500 " | British gum 1:1, | | 100 " Cold water, |
| 15 " | Tartrate of Ammonia | | 8 " Special Fast Violet H, |
| | 42° Tw., | | 300 " Hot water, |
| 60 " | Acetate of Chrome | 500 " | British gum 1:1, |
| | 32° Tw. | 50 " | Violet Acetate of Chrome 32° Tw. |
| 1000 parts. | | 1000 parts. | |

Recipes for Janus Colours.

| | | |
|------|-------|----------------------|
| 20 | parts | Colour |
| 50 | „ | Acetic acid 12° Tw., |
| 50 | „ | Lactic acid 50°/o, |
| 590 | „ | Water, |
| 250 | „ | British gum powder, |
| 30 | „ | Glycerine, |
| 5 | „ | Tartaric acid, |
| 5 | „ | Chlorate of Soda |
| 1000 | | parts |

For all brands of Janus Brown, Janus Blue and Janus Green.

Janus Yellow and Janus Red require an addition of 20 parts Ammonia-Turkey red oil per 1000 parts of printing colour.

B. Shoddy.

Shoddy goods, produced by tearing up coloured woollen rags and mixing with undyed cotton, are generally more or less coloured and mostly present a grey appearance. For this reason these goods can only be dyed in dark shades. For light, bright shades either the rags are sorted, or, if only dark material has been used, the pieces are stripped before dyeing, with Hydrosulphite AZ or NF conc., or by boiling with Potassium Bichromate and Sulphuric acid. For particulars of the stripping process with Hydrosulphite, see page 196.

The dyed shoddy goods are printed with Direct, Basic, or Mordant colours, or are discharged white and in colours.

For dyeing shoddy goods the following methods are employed;

1. The cotton and wool are dyed direct in a neutral or weak alkaline Glauber's salt bath with Dianil colours and neutral dyeing Acid colours such as Azo Yellow conc., Victoria Yellow O, Orange II, Fast Red O, Acid Violet 5BF, Patent Blue A, Naphtalene Green conc. &c.

2. The cotton is first dyed with Patent Dianil Black FF conc., Dianil Black EB conc. etc and the pieces are afterwards dyed to shade with Acid colours in a bath containing Glauber's salt and Sulphuric acid.

3. The cotton is first dyed with Thiazene Black (see page 194) to a grey shade resembling that of the material, and the pieces after-dyed as in No. 2.

4. The wool is first dyed with Acid colours, and the pieces are then aftertreated with Sumach and Iron.

The goods are treated for 5 minutes at 104° F in a bath containing about 10% Sumach extract, squeezed, and treated for 5 minutes in a cold bath of Pyrolignite of Iron 2° Tw.

The first three methods are used principally for thin materials, but the fourth method is used for thick heavy, gentlemen's suitings.

For printing, the recipes given on pages 366 and 367 are used.

Direct Printing on Shoddy Goods dyed in Light Shades.

The direct printing of shoddy goods dyed in light shades is carried out in the same manner as the direct printing of half-wool muslins. For this purpose are used Dianil colours, such as Half Wool Black EBS, to which Glycerine and Sodium Phosphate are added, and Basic colours to which Tannin is added. For shoddy goods containing a large percentage of wool the Acid colours may be used which, of course, are only fixed on to the wool.

In order to fix the colours it is necessary to steam the goods for one hour in the steam box. After printing and steaming, the pieces are washed, brushed, gummed, dried and pressed.

Discharge Printing on Half Wool Muslin and Shoddy Goods.

Pieces intended for discharge printing are well cleansed or bleached (stripped) before dyeing. The shoddy for the discharge effects must be specially selected; it ought to be as light in colour as possible and preferably stripped. The materials must also be free from burls, since the latter often impair the effect. Goods full of burls and containing only a small quantity of wool must first be dyed with Sumach and Iron or with Thiogene Black, but of course, on materials thus prepared, the whites are less pure.

Tin salts and Hydrosulphite are employed for discharging.

1 Tin Salt Discharges.

The following Dianil colours are dischargeable with Tin salts:

| | |
|-------------------------------|-------------------------------|
| Aurophenine O, | Dianil Crimson R, |
| Cresotine Yellow G, | Dianil Blue G, B, R, H&G, |
| Dianil Brown 3GO, R, BD, MH, | Dianil Azurine G, |
| Dianil Fast Brown B, | Dianil Indigo O, |
| Dianil Fast Scarlet 4BS, 6BS, | Dianil Green G, BB, |
| 8BS, RS, GS, | Dianil Dark Green B, |
| Dianil Fast Red PH, | Dianil Black CR, ES, EB conc. |
| Dianil Red 4B, 10B, | Patent Dianil Black FF conc., |
| Dianil Pink BD. | Half Wool Black for printing |
| | EBS |

With Tin salts the undermentioned Acid colours are also dischargeable:

| | |
|--------------------------|----------------------------------|
| Flavazine T, | Brilliant Croceine yellow shade, |
| Flavazine S, | blue shade, |
| Azo Yellow conc., | Fast Red O, S, |
| Fast Yellow O, | Fast Claret Red O, |
| Milling Yellow O, | Amido Naphtol Red G, 2B, 6B, |
| Orange II, IV, G, R, RR, | Azo Acid Red B, |
| Brilliant Orange G, R, | Victoria Violet 4BS, 8BS, |
| Scarlet G, R to 6R, | Azo Acid Blue B, 3B conc., |
| Coccinine O, | Azo Acid Black 3BL extra, |
| Naphtol Red O, | Chromotrope 2R, |
| | Wool Scarlet 2R. |

Below we give some recipes for Tin salt discharges.

Discharge White.

| | |
|-------------|---------------------------------------|
| 200 parts | Tragacanth (60:1000). |
| 400 | „ Acid starch, |
| 180 | „ Sulphocyanide of Am- monia, |
| 200—300 | parts Tin salt cryst. best quality |
| 20 parts | Citric acid |
| 1000 parts. | |

Discharge Yellow.

| | |
|----------|-----------------------------------|
| 30 parts | Auramine conc., |
| 100 | „ Water, |
| 80 | „ Acetic acid 6° Tw., |
| 60 | „ Sulphocyanide of Am- monia, |
| 400 | „ Gum solution 1:1, |
| 250 | „ Tin salt cryst. best quality |
| 15 | „ Citric acid, |
| 60 | „ Acetic acid tannin sol. 1:1, |

1000 parts.

Discharge Pink

| | |
|-------------|---------------------------------------|
| 80 parts | Rosazeine 4G. |
| 5 | „ Rosazeine extra, |
| 150 | „ Acetic acid 6° Tw., |
| 500 | „ Gum solution 1:1, |
| 50 | „ Sulphocyanide of Am- monia, |
| 160 | „ Tin salt cryst. best quality |
| 10 | „ Citric acid, |
| 50 | „ Acetic acid tannin solution 1:1, |
| 1000 parts. | |

Discharge Dark Blue.

| | |
|----------|--------------------------------------|
| 30 parts | Violet Crystals O, |
| 30 | „ Victoria Blue B, |
| 15 | „ Brilliant Green cryst. extra, |
| 20 | „ Persian berry extract 76° Tw., |
| 175 | „ Acetic acid 6° Tw., |
| 450 | „ Gum solution 1:1, |
| 70 | „ Sulphocyanide of Am- monia, |
| 150 | „ Tin salt Ia crystals. |
| 60 | „ Acetic acid tannin solution 1:1 |

1000 parts.

Discharge Red

| | |
|----------|--------------------------------------|
| 75 parts | Rosazeine 4G, |
| 6 | „ Saframine AN extra, |
| 150 | „ Acetic acid 6° Tw., |
| 400 | „ Gum solution 1:1, added cold |
| 60 | „ Persian berry extract 76° Tw., |
| 50 | „ Sulphocyanide of Am- monia, |
| 200 | „ Tin salt cryst. best quality |
| 60 | „ Acetic acid tannin solution 1:1 |

1000 parts.

Discharge Green.

| | |
|----------|--------------------------------------|
| 20 parts | Brilliant Green cryst. extra, |
| 10 | „ Auramine conc., |
| 154 | „ Acetic acid 6° Tw., |
| 400 | „ Acid starch, |
| 18 | „ Citric acid, |
| 80 | „ Sulphocyanide of Am- monia, |
| 240 | „ Tin salt Ia crystals, |
| 80 | „ Acetic acid tannin solution 1:1 |

1000 parts.

The Tin salt discharges are steamed for 5—10 minutes in the Mather Platt with moist steam at 212° F., or they are steamed for ½—1 hour without pressure. Where other illuminating colours have been printed along with the discharge colours, the latter method of steaming is to be recommended; however it must be borne in mind that the cotton fibre is easily injured by Tin salts, and consequently the Hydrosulphite discharges are now principally used.

2. Hydrosulphite Discharges.

The following Dianil colours are easily dischargeable with Hydrosulphite:

| | |
|-------------------------------|--------------------------------------|
| Cresotine Yellow G, | Dianil Blue H6G, G, B, R, 2B, |
| Aurophenine O. | " " 3B, H3G, H2G, BX, |
| Dianil Pink BD, | " " 3R, 4R, HG, 2R. |
| Dianil Crimson B, G, | Dianil Indigo O, |
| Dianil Red B, 4B, | Dianil Pure Blue FF, |
| Dianil Red 6B, 10B and R, | Dianil Dark Blue R, |
| Dianil Fast Scarlet 8BS, | Dianil Green G, B and BB, |
| Dianil Fast Red PH, F, | Dianil Dark Green B, |
| Dianil Scarlet 2R and G, | Dianil Black CB, CR, PR, |
| Dianil Claret Red B and G, | R, ES, |
| Dianil Violet H, | Patent Dianil Black FF conc., |
| Dianil Brown 3GO, G, 2G, | " " " FFC conc., |
| " " M, MH, BD, | " " " FFT conc. |
| " " B, D, R, 3R, | " " " EB conc., |
| Dianil Fast Brown G, B and R, | " " " FB conc., |
| Dianil Azurine G, | " " " EBV conc., |
| Dianil Japonine G. | Half Wool Black for printing EBS. |

A list of Acid colours, suitable for Hydrosulphite discharges, is given on page 227.

Of neutral dyeing Acid colours (applied in a Glauber's salt bath) the following are chiefly to be considered.

Fast Red O, Orange II, Azo Yellow O, Acid Violet 5BF,
Patent Blue A, Naphtalene Green conc., Neutral Blue R
and Neutral Violet O.

The following shades are often dyed on shoddy:

a) Blacks.

1. The goods are dyed direct with 4% Half Wool Black W or Half Wool Black EBS, or with 3% Half Wool Black for printing EBS,
0.5% Patent Blue A and
0.25% Fast Red O,

with the addition of 50% Glauber's salt. Dyeing is commenced at the boil and the bath exhausted for 1 hour at 140° C.

2. The cotton is first dyed with 2.5% Patent Dianil Black FF conc. in a bath containing Glauber's salt and Soda. The wool is then dyed with 2.5% Discharge Wool Black GH, with the addition of 10% Glauber's salt and 2% Sulphuric acid or 5% Acetic acid.

3. The wool is first dyed with Discharge Wool Black GH, and the cotton subsequently dyed with Sumach and Iron (see page 368) (4). This method is used principally for heavy goods.

b) Blues.

1. The wool and cotton are dyed direct in a Glauber's salt bath for 1½ an hour at the boil, and the pieces allowed to run for 1 hour without steam.

3% Dianil Blue B,
1.5% Dianil Black CR,
0.5% Patent Blue A,
1% Acid Violet 5BF,
50% Glauber's salt, 0.5% Soda.

2. The cotton is first dyed with 2.5% Patent Dianil Black FF conc. in a weak alkaline Glauber's salt bath, then the wool is dyed either with 1% Acid Violet 5BF and 0.5% Patent Blue V, or with 2% New Discharge Blue RH.

3. The wool is first dyed with Acid colours, e. g. with 1.5% Acid Violet 5BF and 0.5% Patent Blue V; the cotton is afterwards dyed with Sumach and Iron (page 368) (4).

In a similar manner various shades of Brown, Green, Olive etc. may be produced, by first dyeing the cotton grey with Patent Dianil Black or Thiogene Black, and dyeing the wool with Flavazine T, Orange D, Scarlet 3R, Patent Blue V, Naphtalene Blue B, Azo Acid Blue B etc.

Red, Claret, Blue, Green, Olive and Light Brown can also be produced on light coloured shoddy goods in a neutral Glauber's salt bath, by means of Dianil Red PH, 10B, Dianil Crimson B, Dianil Brown 3GO, BD. MH etc., Dianil Green G, BB, BBN and Dianil Blue along with the addition of neutral dyeing Acid colours.

Recipes for Hydrosulphite Discharges.

White Discharge I.

| | |
|-------------|-----------------------|
| { 110 parts | British gum powder, |
| { 338 .. | Water, |
| | boiled then added |
| { 300 .. | Hydrosulphite NF |
| { 120 .. | Zinc White, |
| 20 .. | Glycerine, when cold: |
| 20 .. | Turpentine, |
| 90 .. | Ammonia, |
| 2 .. | Ultramarine |
| 1000 parts. | |

White Discharge II.

| | |
|-------------|---------------------|
| { 110 parts | British gum powder, |
| { 428 .. | Water, |
| | boiled then added |
| { 100 .. | Hydrosulphite NF |
| | conc, |
| { 220 .. | Zinc White, |
| 20 .. | Glycerine, |
| 20 .. | Turpentine, |
| 90 .. | Albumen 1:1, |
| 10 .. | Ammonia, |
| 2 .. | Ultramarine |

1000 parts.

Red Discharges with Chrome.

| | |
|-------------|--|
| { 50 parts | Rosazeine G extra. |
| | (or Eosine dyestuff) |
| { 30 .. | Glycerine, |
| { 320 .. | Water, |
| { 200 .. | British gum powder, |
| { 100 .. | China clay are boiled together, then added cold, |
| 100 .. | Acetate of Chrome |
| | 32° Tw. |
| { 100 .. | Hydrosulphite NF |
| | conc., |
| | dissolved in |
| { 100 .. | Water, and cooled. |
| 1000 parts. | |

Coloured Discharges with Tannin.

| | |
|------------|-------------------------|
| { 30 parts | Colour* |
| { 40 .. | Glycerine, |
| { 200 .. | Water, |
| { 50 .. | Wheat starch, |
| { 50 .. | Dextrine, |
| { 100 .. | Water, |
| { 100 .. | China clay, |
| { 100 .. | Water, |
| | boiled, cooled and |
| 50 .. | Alcohol, |
| 60 .. | Aniline Oil (or Phenol) |
| 150 .. | Hydro-sulphite NF |
| | conc 2:1, |
| 70 .. | Tannin-Glycerine 2:1 |
| | added |

1000 parts.

Coloured Discharges with Albumen

| | | |
|-------|--------|-------------------------------------|
| 100 | parts | British gum powder. |
| 100 | „ | Water, |
| 40 | „ | Colour ^{*)} , |
| 20 | „ | Glycerine. |
| 240 | „ | Water, |
| | | boiled, and added cold: |
| 50 | „ | Alcohol, |
| 100 | „ | Zinc White made into a paste with |
| 100 | „ | Water, |
| 100 | „ | Hydrosulphite NF conc. dissolved in |
| 5 | „ | Hot water and cooled, |
| 90 | „ | Albumen 1:1, |
| 10 | „ | Ammonia |
| <hr/> | | |
| 1000 | parts. | |

*) The following dyestuffs are suitable for coloured discharges: Auramine O, Methylene Yellow H, Flavophosphine 2G conc., G conc., R conc., Leatner Yellow O, Discharge Red NF, Rosazeine G extra, B extra, 6G extra, 6GD extra, Discharge Navy Blue S extra, Thionine Blue GO, New Metnylene Blue N.

The following Acid colours, which are fixed only on wool, may be mentioned as being stable to Hydrosulphite, and produce coloured discharges fast to rubbing: Chinoline Yellow O, New Discharge Red R, G and Lanocyanine W paste:

| | Yellow | Blue | Red | |
|-------------------------|----------|-------------|-----------|-------------------|
| Chinoline Yellow O, | 50 parts | — | 500 parts | Standard Colour A |
| Lanocyanine W paste, | — | „ 120 parts | 500 „ | „ „ B |
| Water, | 280 | „ 205 | „ | 1000 parts. |
| China clay 1:1, | 200 | „ 200 | „ | |
| British gum powder, | 100 | „ 120 | „ | |
| Alcohol | 50 | „ 50 | „ | |
| British gum 1:2. | 120 | „ 105 | „ | |
| Hydrosulphite NF conc., | 100 | „ 100 | „ | |
| Gum solution 1:2 | 50 | „ 50 | „ | |
| Glycerine | 50 | „ 50 | „ | |

make up to 1000 parts.

Standard Colour for Red.

| | A. | B |
|------------------------|----------|----------|
| New, Discharge Red G | 50 parts | — |
| Rosazeine 6GD extra | — | 50 parts |
| | <hr/> | |
| Water | 195 | parts |
| China Clay paste 1.1 | 200 | „ |
| British gum powder | 100 | „ |
| Alcohol | 50 | „ |
| British gum 1:2 | 205 | „ |
| Hydrosulphite NF conc. | 100 | „ |
| Gum solution 1:2 | 50 | „ |
| Glycerine | 50 | „ |

make up to 1000 parts

When producing multi-coloured prints the coloured discharges are printed before the white discharge.

The printed and dried goods are moistened by plaiting down in a damp and cool atmosphere, and are then immediately steamed Hydrosulphite white discharges, and also white discharges along with which are printed coloured discharges (small designs), are steamed for 5 minutes at 212—216° F., in the Mather-Platt, free from air. Coloured discharges, when used for large designs, require steaming for $\frac{1}{2}$ —1 hour with moist steam in the steam box. After steaming the goods are washed, dried and finished. Lower quality shoddy goods are finished off without washing.

HALF SILK PRINTING.

The preparatory processes consist of singeing and bleaching. The pieces are soaped for $\frac{1}{2}$ an hour at the boil in a liquor containing 5 parts of Olive oil soap per 1000, and then rinsed. For bleaching, the bath is made up as follows:

| | |
|-----------|-----------------------------|
| 100 parts | Hydrogen Peroxide |
| 900 „ | Water |
| 5 „ | Ammonia |
| 20 „ | Ammonia Turkey Red oil 50%. |

The goods are entered into the cold bath and allowed to remain at this temperature for 3 hours; the temperature is then raised to 160–170° F. and the material allowed to remain for a further 8–10 hours in the bath. The pieces are then washed and dried. Half-silk piece goods are printed in a similar manner to cotton piece goods, Basic-, Mordant-, and Direct colours being employed for the purpose. Azo colours produced on the fibre are less suitable for half-silk goods on account of their tendency to rube.

As in calico printing, so also in half-silk printing, the Direct-, Resist-, and Discharge styles find ample application.

A. Direct Printing.

For direct printing with Basic colours the printing recipes 1 and 2 on page 254 are used: Induline for Printing is employed according to the recipe given on page 256.

The recipes given on pages 260–265 are employed for direct printing with Mordant colours.

Direct colours are printed according to the recipe given on page 276. These colours can be combined with several Acid colours and with the Eosines for the purpose of shading. For example, Phloxine may be used as an addition to Dianil Pmk BD, Dianil Red etc.

Aniline Black is printed on half-silk according to the following recipe:

| Aniline Oxidation Black. | | Thickening for Black | |
|--------------------------|-----------------------|----------------------|-----------------------------|
| { 120 parts | Aniline Salt, | 150 parts | Wheat starch, |
| { 230 „ | Water, | 100 „ | Tragacanth (60:1000). |
| 600 „ | Thickening for Black. | 180 „ | Burnt starch, |
| | Add before use: | 476 „ | Water, |
| 50 „ | Sulphide of Copper | 30 „ | Tournant oil, |
| | paste 20%. | 2 „ | Magenta small cryst. |
| 1000 parts. | | | Boil, and add when lukewarm |
| | | 60 „ | Chlorate of Soda, add |
| | | | cold, |
| | | 2 „ | Sulphocyanide of Potassium |
| | | 1000 parts. | |

After printing and drying, the pieces are oxidised in the oxidation chamber at 86-90° F until the black is fully developed; they are then passed through a solution of Bichrome (5-10 parts per 1000) at 140° F., washed and soaped.

The following recipe is used for Diphenyl Black:

| | | | |
|----|---|-------------|--|
| A. | { | 40 parts | Diphenyl Black Base I are dissolved in |
| | { | 100 „ | Acetic acid 50% and |
| | { | 46 „ | Lactic acid 50% and stirred into |
| | { | 300 „ | Tragacanth (60:1000) |
| | { | 30 „ | Chlorate of Soda dissolved in |
| | { | 60 „ | Water |
| B. | { | 200 parts | Tragacanth (60:1000) |
| | { | 172 „ | Water |
| | { | 18 „ | Chloride of Alumina 52° Tw. |
| | { | 20 „ | Sulphide of Copper paste 30% |
| | { | 20 „ | Glycerine |
| | | 1000 parts. | |

Before use, standard B is stirred into A.

After printing, the goods are steamed in the Mather-Platt for 3 minutes, or for 1 hour in the steam-box, passed through an alkaline soap bath, washed and soaped.

Nitroso Blue on half-silk is printed according to the recipe on page 313: for the recipes for Nitroso Brown and Nitroso Green, see page 286

B. Resist and Discharge Printing.

For the production of Aniline Black (Prudhomme Black) resists the padding bath given on page 155 is used. White and coloured resists are given on page 307. Nitroso Blue is employed for the production of dark navy blue shades on half-silk. The material is cleansed by passing through a Soda bath after which it is soured. The carefully dried material is printed with the following white resist, and then padded on the three roller padding machine, or on the printing machine with the Nitroso padding colour. The goods are then steamed for 5-15 minutes without pressure, passed through a tartar emetic bath, washed and soaped.

| White Resist. | | Thickening (for reducing the white resist). | |
|---------------|--------------------------|--|----------------------|
| 170 parts | British gum, | | |
| 195 | „ Water, | 350 parts | British gum, |
| 130 | „ Glue sol 1:2, | 400 | „ Water, |
| 85 | „ Acetic acid 12° Tw., | 170 | „ Glue solution 1:2, |
| 250 | „ Tin salts 1a crystals, | 80 | „ Acetic acid 12° Tw |
| 170 | „ Tartaric acid | 1000 parts | |
| 1000 parts. | | | |

Padding Bath.

| | | |
|-------------|----------|------------------------------|
| { | 50 parts | Nitroso Base M 50% paste, |
| | 16,7 | „ Hydrochloric acid 36° Tw.. |
| | 140 | „ Water, |
| { | 33 | „ Resorcine, |
| | 85 | „ Hot water, |
| | 100 | „ Tannin solution 1:1, |
| | 420 | „ Oxalic acid solution 1:10, |
| | 100 | „ Tragacanth (60:1000) |
| 1000 parts. | | |

For the purpose of discharging half-silk goods, Hydrosulphite discharges are now employed instead of Zinc-Bisulphite discharges, which latter tend to stick in the engraving of the printing roller. Of dyestuffs used in discharge printing, the following Dianil colours are the most important:

Aurophenine O,
 Cresotine Yellow G,
 Dianil Brown 3GO, G, BD, aftertreated with Azophor Red,
 Dianil Fast Brown B, aftertreated with Azophor Red,
 Dianil Blue B, G, 2R, 4R,
 Dianil Indigo O,
 Dianil Dark Blue R, 3R,
 Dianil Azurine G,
 Dianil Green BBN,
 Dianil Fast Scarlet 4BS, 6BS, GS, RS,
 Dianil Black CR, N, PR, direct, and aftertreated with Azophor Red,
 Patent Dianil Black EB conc, FF conc.,
 Half Wool Black for Printing FBS.

The Acid colours given on page 248 are used for the purpose of shading the silk.

Half-silk goods are dyed as follows:

Navy Blue.

The dye-bath containing 30 times the amount of liquor compared to the weight of the material, is prepared with 2 parts Olive oil soap, 0.2 parts Soda, 5 parts of Common salt per 1000 parts, and

5% Dianil Dark Blue R,
 2% Dianil Black CR,
 2% Alkaline Blue No. 2.

The goods are entered at 122–140° F., the temperature raised slowly to the boil, and boiling continued for 1 hour. After rinsing, the

goods are dyed in a bath containing 50 fold the amount of water, to which are added 5 parts of Sulphuric acid (1:10) per 1000, with

0.15% Flavazine T,
0.025% Acid Violet 5BF, } per 100 lbs. of goods.

The goods are dyed for $\frac{1}{4}$ of an hour at about 86° F, and for $\frac{1}{4}$ of an hour at 158—176° F. They are then washed and finished with Sulphuric acid.

Black.

The goods are dyed in the 30 fold amount of water. The dye-bath is prepared with 2 parts of Olive oil soap, 5 parts of Common salt, 0,2 parts of Soda per 1000 parts and

8% Dianil Deep Black B.

After entering the goods at 122—140° F., the temperature of the bath is slowly raised to the boil, and boiling continued for 1 hour. The goods are then washed and treated in a second bath, containing the 50 fold amount of water, with 2% Discharge Black NF and an addition of 5 parts Sulphuric acid (1:10) per 1000. The goods are entered at 86° F, and the temperature raised in about $\frac{1}{4}$ of an hour to 158—176° F. After rinsing, the goods are finished with Sulphuric acid.

The recipes for white Hydrosulphite discharges are given on page 336; for coloured Hydrosulphite discharges see page 338.

The goods which have been printed with the discharges must be well dried before steaming; the latter operation is carried out in the Mather-Platt with powerful steam (free from air) at 212—222° F. In case longer steaming is required the goods may also be treated in the steam-box with dry steam. They are then washed and dried.

FLAX OR LINEN, HEMP AND RAMIE.

Linon is prepared for dyeing by boiling or bleaching. The latter is much more complicated and takes up much more time than the bleaching of cotton. Whilst here there are on an average 5% of extraneous matter to be removed, the perfect bleaching of linen involves a loss in weight up to 30%. Besides, the brown dyed pectic substances of linen adhere far more tenaciously to the fibre. And, furthermore, the linen fibre is more susceptible to the action of alkalis and acids, so that great care has to be exercised in the bleaching process. Before all, only weak chlorine and acid baths may be used; Sodium Hypochlorite takes the place of Chloride of Lime. Only by repeated treatment with diluted lyes, acids etc. can bleaching be effected without tendering the fibre.

Linon is dyed in the same manner as cotton. Owing to the greater hardness of the linen fibre, the penetration is more difficult than in the case of cotton. A thorough boiling of the linen with 5—10% Soda, with the addition of Soap if necessary, is therefore advisable in most cases.

In dyeing with Basic colours the tannating must be done as hot as possible, and Acetic acid or Alum added to the dyebath.

In dyeing with Direct colours it is advisable to add some Turkey red oil to the dyebath, and to work with only small quantities of salts; if required, by increasing the addition of Soda, the slowest possible exhaustion of colour from the bath can be obtained.

The Thiogene colours are also best dyed with the addition of Turkey red oil and rather larger quantities of Sodium Sulphide than are used for cotton.

The principal linen goods are the blue materials used for workmen's clothing, which are generally dyed with Indigo. Where there is a question of more thorough dyeing, it is necessary to operate on the sinking frame, and in the Zinc-lime or the Vitriol vat. For continuous dyeing the Hydrosulphite vat is used.

The same recipes are applicable for the dyeing of half-linen goods.

Hemp resembles flax in its behaviour to chemicals and dye-stuffs. Its chief use is for the manufacture of twine, rope, sailcloth, and bagging.

Hemp is bleached for light shades only. It is soaked in a solution of 2—3% water-glass and then boiled in water. Soaking in a very weak clear solution of Chloride of Lime and subsequent souring off with very dilute Muriatic acid completes the bleaching operation.

The Basic colours are dyed on Tannin-Antimony mordant, or direct in a weak acid bath.

The Indian Nettle fibres, Ramie or Rhea, and Chinagrass, imported from China, greatly resemble cotton in respect to their behaviour in dyeing. For dyeing these fibres Basic colours on Tannin Tartar-Emetic mordant, also Dianil and Thiogene colours are used, Ramie is put upon the market as a white fibre; consequently before dyeing it is sufficient to wet it in a weak Soda bath at 140—176° F.

JUTE, COCOA-NUT FIBRE, PIASSAVA, SISAL ETC.

Jute stands between cotton and wool in its behaviour in dyeing. Owing to the Tannin-like incrustations which cover it, jute is capable of fixing Basic dyestuffs direct, without previous mordanting. It is mainly employed in the manufacture of coarse fabrics, bagging, curtains and carpets.

Owing to its great capability of reaction the jute fibre is weakened by most bleaching substances; great care is therefore necessary in the employment of Chlorine preparations. On examination of a number of proposed methods the following, by A. Busch is to be recommended.

1. Soaking in warm water overnight.
2. Boiling with 5 parts Soda per 1000 parts water for $\frac{1}{2}$ an hour.
3. Putting into Chloride of Lime solution 1° Tw. for 10 hours, and wringing out
4. Putting into Hydrochloric acid 1° Tw. for 1 hour, and washing well.
5. Putting into Permanganate of Potash ($2\frac{1}{2}$ parts per 1000) for 1 hour, and rinsing.
6. Putting for $\frac{1}{2}$ hour into a solution of Bisulphite containing 80 parts (72° Tw.) per 1000.
7. Washing, blueing, soaping.

For most purposes of dyeing, half-bleaching is sufficient; jute is also frequently dyed in the raw state, or after being cleansed with Soda.

The Basic, Dianil and Thiogene colours are suitable for jute dyeing. In addition to these, Acid Wool colours are also used for dyeing jute and other vegetable fibres.

For dyeing cocoa-nut fibre the same dyestuffs and methods can be used as for jute.

The cocoa fibre is brought into the boiling dyebath either direct, or after a previous passage through a Soda solution of 1°.

For dyeing Piassava the same dyestuffs are used as are employed on jute.

Fibre, Sisal etc. are used for upholstering and brush materials, and are mostly dyed black, for which the direct Patent Dianil Black brands are suitable. The bath is prepared with about 3% Dyestuff, 2% Ammonia, 0.5% Soda and 5% Glauber's salt; the goods are entered at the boil and left at that temperature for

1 hour. They are then worked for another $\frac{1}{2}$ hour without steam, rinsed and dried.

The dyestuffs for these various fibres are divided into the following groups

Basic and Acid Colours.

The Basic colours are mixed with a little Acetic acid, and carefully dissolved by pouring boiling water over the colour. The solution thus obtained is then added to the cold dyebath containing 5–10% Alum, after which the goods are entered and dyed for $\frac{1}{4}$ of an hour in the cold bath. The temperature is then raised to 158–176° F. in $\frac{1}{2}$ an hour, and the material dyed for 20 minutes at this temperature. The fastness of the colours may be increased by heating the dyebath to the boil, but in so doing the colours lose brightness.

The Acid colours are dyed like the Basic colours, with which they are combined. In the case of Acid Violet, the shade is favourably influenced by the addition of 2–3% of Oxalic acid to the dyebath.

The following colours are especially suitable for jute.

| | |
|---|------------------------------------|
| Auramine conc., O, I, II, | Victoria Blue B, R, 4R, |
| Flavophosphine 2GO new, | Methylene Blue, all brands, |
| Azophosphine GO, BRO, | Methylene Dark Blue RBN, |
| Chrysodine A cryst., C cryst., | Peacock Blue O, |
| C extra crystals, | Indamine Blue N extra, NB, |
| Vesuvine 4BG conc., 3R superior, O, | Fast Blue for cotton BB, |
| Leather Yellow O, G, GG, | New Fast Blue 3R cryst., |
| Cutch Brown D, | Ethyl Blue BF, |
| Leather Brown O, | Indophene Blue B, |
| Dark Brown M, | Methylene Blue NF, |
| Piassava Brown O, | Malachite Green crystals extra, |
| Brown O, | Brilliant Green crystals extra, |
| Leather Red O, R, G, | Metanil Yellow extra, |
| Saffian Red O, | Brilliant Orange G. O. |
| Magenta small crystals, large crystals, | Azo Brown V, |
| Cerise G, R, | Scarlet B extra, |
| Grenadine O, R, RR, | Janus Red R, |
| Russia Red D, 5001, | Janus Brown R, B, |
| Maroon O. extra, | Janus Blue G, B, R, |
| Cardinal R. G, | Janus Black O, I, II, |
| Methylene Green, all brands, | Chinoline Yellow O, |
| Coal Black O, I, II, III. | Flavazine L, |
| Janus Yellow G, R, | Azo Yellow conc., |
| New Magenta O. | Victoria Yellow conc., |
| Safranine O, | Orange G, No. 2, No. 4, |
| Scarlet for Cotton O. | Fast Red O, |
| Methyl Violet, all brands, | Victoria Scarlet G, 3G, R—6R, |
| Pure Blue O, conc., | Acid Violet 5BF, 7BN, |
| Blue for Jute and Linen, | Opal Blue blue shade, green shade, |
| Cotton Light Blue O, | Fast Blue soluble in water, |
| Cotton Blue B, BB, R, | Acid Green conc., |
| Soluble Blue R, | Naphtalene Green conc., V. |

Some Basic and Acid colours are dyed in a neutral Salt bath containing 50–70 parts of Salt per 1000. The following colours belong to this class:

| | |
|---------------------|--------------------------------|
| Rosazine O, 4G, | Rose bengale G, |
| Rosazine Scarlet G, | Brilliant Croceine blue shade, |
| Phloxine O, | yellow shade, R, B—6 B |
| Erythrosine extra, | |

Dianil Colours.

These are dyed at the boil with the addition of 20–40% Glauber's salt crystals and 1–2% Soda (calcined). (The Dianil Blues are dyed without Soda). All the Dianil colours are suitable for jute dyeing, but the most important are the following:

| | |
|--------------------------|-------------------------------|
| Dianil Yellow HS, | Dianil Fast Red PH. |
| Aurophenine O, | Dianil Fast Scarlet 8BS, |
| Dianil Direct Yellow S, | Dianil Claret Red G, B, |
| Dianil Orange N, | Dianil Violet H, |
| Toluylene Orange R, | Dianil Green G, B, BB, |
| Dianil Brown 3GO, 3R. M, | Dianil Dark Green B, |
| MH, D, BD, | Dianil Blue, all brands, |
| Dianil Copper Brown O, | Dianil Dark Blue 3R, R, |
| Dianil Fast Brown B, | Patent Dianil Black EB conc., |
| Dianil Red 4B, | FF conc., EBV conc., EBV |
| Delta Purpurine 5B. | extra conc. |

Thiogene Colours.

These are dyed in the usual way, viz. for about 1 hour at the boil, with the addition of Sodium Sulphide, Soda, and Glauber's salt. They are employed in all cases where great fastness is required, the following colours being chiefly used.

| | |
|---------------------------|------------------------------|
| Thiogene Yellow GG, G, | Thiogene Blue B. |
| Thiogene Brown GC, GR, S, | Thiogene Coal Black O conc.. |
| Thiogene Cyanine G, O, | Thiogene Black liquid M. |

STRAW.

For dark shades the straw is boiled in water free from lime for $1\frac{1}{2}$ —2 hours before dyeing. The boiled material is entered into the cold dyebath: the temperature is raised to the boil within $\frac{3}{4}$ of an hour, and the material boiled for another hour. If the water contains lime, a corresponding addition of Acetic acid must be made.

For light colours the boiled-off straw is bleached: for this purpose Sulphurous acid (stoving), or Sodium Peroxide is used. For 20 galls of soft water $4\frac{1}{4}$ lbs. of Oxalic acid are added and afterwards 2 lbs. of Sodium Peroxide are slowly stirred in. Waterglass (Silicate of Soda) is now added until the bath is faintly alkaline, and the straw is treated in this liquor at about 104° F. After bleaching, the material is washed, soured, and dried at a low temperature.

The following dyestuffs are suitable for straw dyeing:

| | |
|-----------------------------------|---------------------------------|
| Auramine conc., O, I, II, | Cardinal G, R. |
| Phosphine extra, O, | New Magenta O, |
| Leather Yellow O, G, GG, 3G, | Methylene Violet 3RA extra, |
| Leather Red O, G, R, | RRN, BN, |
| Leather Brown O, | Safranine GGS, AN extra, O. |
| Chrysoidine A crystals, C cryst., | conc., |
| C extra crystals, | Brilliant Green crystals extra, |
| Vesuvine, all brands, | Mala: hite Green cryst. extra, |
| Magenta, all brands, | Methylene Violet, all brands, |
| Cerise G, R, | Methylene Blue, all brands. |
| Grenadine O, R, RR, | Methylene Green, all brands. |
| Fast Blue for Cotton, all brands. | New Fast Blue 3R crystals, |
| Rosazine O, B, extra, B extra, | Janus Brown B, R, |
| 4G, 4G extra, | Janus Black I, |
| Janus Yellow G, R, | Leather Black T, TM, No. 5068. |
| Janus Red B, | Coal Black, all brands, |
| Janus Blue B, | Azo Yellow conc., |
| Janus Green G, | Orange No. 4. |
| Maroon O, extra. | |

WOOD AND BAST.

Wood and bast are bleached with Hydrosulphite. The process is similar to that given on page 98, for the stripping of wool with Hydrosulphite.

Wood and bast are dyed in a similar manner to jute. Basic colours are principally used and dyed in a neutral bath at 158—176° F.

Eosines are dyed with very small quantities of Acetic acid. Brilliant Croceine, Rosaniline Blue, Soluble Blue and Pure Blue are dyed with the addition of 2—4% Alum.

Dianil colours are dyed at 158—176° F., with the addition of 25% Glauber's salt; Thiogene colours after the known rules of cotton dyeing.

Thin pieces of wood, e. g. match stalks, are dyed by dipping them into the dyestuff solution; wood-veneers are coloured by brushing on the colour solution. Thicker pieces, such as walking sticks etc. are well dried and packed in a pressure apparatus, in which they are treated with dyestuff solution at about 80 atmospheres pressure.

Whole tree trunks are dyed in the following manner: The two ends of the tree trunk are encircled with suitable lead rings connected with a pump, by means of which the sap is removed, and then the dyestuff solution forced through.

ARTIFICIAL SILK.

ARTIFICIAL STRAW, ARTIFICIAL HORSE-HAIR.

Of artificial fibres the following are chiefly to be considered

1. Fibres produced from Nitro-Cellulose (Chardonnet or Besançon silk, Lehner or Frankfort silk, Meteor)
2. Fibres produced by dissolving Cellulose in Ammoniacal Copper solutions (Glanzstoff, Elberfeld silk, Aix-la Chapelle silk, Pauly silk, Sirius)
3. Fibres produced from Viscose (Viscose silk, Viscelline yarn).

The first named class of fibres differ from those of the other two classes, in that they may be dyed in full shades with Basic colours without the aid of mordants.

Artificial silk is generally bleached by means of Calcium or Sodium Hypochlorite. The well wetted material is treated for about 10 minutes in a bath containing 10 parts of active Chlorine per 1000; after allowing the liquor to drain off, the yarns are slightly rinsed, and then soured in Sulphuric acid $\frac{3}{4}$ ° Tw.; if necessary the treatment may be repeated. Finally, the silk is well rinsed, passed through a strong soap bath, in which it may also be blued, and then dried without further rinsing. Artificial horse-hair and artificial straw are bleached by steeping for about $\frac{1}{2}$ an hour in a concentrated Hypochlorite of Soda solution.

For the dyeing of artificial fibres are used:

1. Janus Colours.
2. Basic Colours.
3. Acid Colours.
4. Dianil Colours.
5. Thiogene Colours.

Janus, Basic and Acid colours are dyed for $\frac{1}{4}$ of an hour in a cold bath acidified with 2—5% Acetic acid or Alum; the temperature is then raised to 140° F. and dyeing continued for $\frac{1}{2}$ an hour.

Janus Colours.

On Nitro-Cellulose fibres (Chardonnet silk, Lehner silk etc) the Janus colours produce shades fast to water, without the aid of mordants. On the other fibres, however, if fast, deep shades are required, they must be dyed on a Tannin mordant. Janus colours are the most suitable class of dyestuffs for dyeing artificial silk.

Janus Black produces the finest black obtainable on artificial silk, whilst the blue dyestuffs of this series are also largely used for dyeing navy blues.

Janus Black O, I, II, IV,
 Janus Blue G, B, R,
 Janus Yellow G, R.
 Janus Red R.
 Janus Brown R, B,
 Janus Green G, B.

Basic Colours.

The Basic colours dye the Nitro-Cellulose fibres in deep shades direct; the other fibres may be dyed direct in light and medium shades. However, where fastness is required, it is advisable in all cases to dye on a Tannin mordant.

| | |
|-----------------------------------|-------------------------------|
| Auramine conc., O, I, II, | Maroon O, extra, |
| Flavophosphine 2GO, new, | Cardinal R, G, |
| Azophosphine GO, BRO, | New Magenta O, |
| Chrysoidine A crystals, C cryst., | Safranine O, |
| C extra crystals, | Scarlet for Cotton O, |
| Vesuvine 4BG conc., 3R super O, | Magenta Violet, all brands, |
| Leather Yellow O, G, GG, | Violet B, R, 4R, |
| Cutch Brown D, | Methylene Blue, all brands, |
| Leather Brown O, | Methylene Dark Blue RBN, |
| Dark Brown M, | Peacock Blue O, |
| Piassava Brown O, | Indamine Blue N extra, NB, |
| Brown O, | Fast Blue for Cotton BB, |
| Leather Red O, R, G, | New Fast Blue 3R cryst, |
| Saffran Red O, | Ethyl Blue BF, |
| Magenta, | Indophene Blue B, |
| Cerise G, R, | Malachite Green cryst. extra, |
| Grenadine O, R, RR, | Brilliant Green cryst. extra, |
| Jute Red D, 5001. | Methylene Green, all brands, |
| | Coal Black O, I, II, III. |

Acid Colours.

Acid colours are seldom employed on artificial silk; they are used however for light shades, and for bright reds (not fast to water), also for blue and very pure greenish-yellow shades. The baths do not exhaust and may be used again.

| | |
|-------------------------------|-------------------------------|
| Chinoline Yellow O, | Brilliant Orange G, |
| Flavazine L, | Azo Brown O, |
| Azo Yellow conc., | Brilliant Croceine R, B, blue |
| Victoria Yellow conc, | shade, |
| Metanil Yellow extra, | Phloxine O, |
| Acid Rosamine A, | Patent Blue, all brands, |
| Rose Bengale, | Patent Green, all brands, |
| Fast Acid Violet, all brands, | Acid Green conc., |
| Acid Violet 5BF, | Naphtalene Green, all brands, |
| Soluble Blue, all brands, | Fast Dark Blue R, |
| Opal Blue, all brands, | Acid Alizarine Grey G, |
| Blue for Jute and Linen, | Fast Blue, soluble in water |
| Orange G, No. 2, No. 4. | |

Dianil Colours.

The Dianil colours are dyed for 1 hour cold to 140° F., with the addition of 10–15% Salt, and, if necessary, some Soda.

| | |
|--------------------------|----------------------------------|
| Aurophenine O, | Dianil Fast Red PH, |
| Dianil Direct Yellow S, | Dianil Fast Scarlet, all brands, |
| Dianil Orange N, | Dianil Claret Red G, B, |
| Toluylene Orange R, | Dianil Violet H, |
| Dianil Brown 3GO, 3R, M, | Dianil Green, all brands, |
| MH, D, BD, | Dianil Dark Green B, |
| Dianil Copper Brown O, | Dianil Blue H6G, |
| Dianil Fast Brown B, | Patent Dianil Black EB conc., |
| Dianil Red 4B | FF conc., EBV conc., EBV |
| Delta Purpurine 5B, | extra conc. |

Thiogene Colours.

The Thiogene colours are used for producing very fast shades on artificial horse-hair and artificial straw; they are only seldom employed on artificial silk. These colours are dyed cold, with the addition of Sodium Sulphide, Soda and (Salt Compare tables page 125).

The following colours are suitable for dyeing artificial silk :

| | |
|----------------------------|-----------------------------|
| Thiogene Yellow G, GG, | Thiogene Rubine O, |
| Thiogene Golden Yellow AO, | Thiogene Dark Red R, |
| Thiogene Orange R, RG, RR | Thiogene Violet V, B, |
| Thiogene Brown GC, G2R, GR | Thiogene Heliotrope O, |
| R, S, | Thiogene Cyanine O, G, |
| Thiogene Khaki O, | Thiogene Green BL extra, GL |
| Thiogene Catechu R, | extra, GG. |

All Thiogene colours may be used for dyeing artificial horse-hair, artificial straw, and other coarse artificial fibres.

PAPER DYEING.

Coloured paper can be produced:

1. by dyeing in the pulp, i. e. by dyeing the material while still in the pulping machine,
2. by immersing the finished unsized or slightly sized paper in dyestuff solutions,
3. by dyeing the surface of the paper.

I. THE DYEING OF PAPER IN THE PULP.

The well ground material is dyed in the beating machine by adding the dyestuff in the form of a very dilute solution. For the different groups are employed, they must be dissolved separately and added one after the other. The Resin soap and Aluminium sulphate, which are necessary for sizing, in many cases completely precipitate the dyestuffs on the fibre in the form of lakes. Resin soap precipitates the Basic colours as insoluble resinous salts; Aluminium sulphate (for Resorcine colours it is better to use Acetate of Alumina) precipitates Resorcine-, Acid-, and Azo colours as Aluminium compounds. For unsized paper, dyestuffs are used which are fixed without the aid of precipitating agents; these are chiefly Direct and Basic colours. However, where an addition of Sulphate or Acetate of Alumina is made, dyestuffs belonging to other groups can also be employed for dyeing unsized paper.

The following colours are suitable for dyeing paper in the pulp:

Basic Colours.

| | |
|------------------------------|--------------------------|
| Auramine, all brands, | Magenta, all brands, |
| Fluorophosphine, all brands, | Cerise, all brands, |
| Chrysamine, all brands, | New Magenta, all brands, |
| Vesuvine, all brands, | Grenadine R, G, O, |
| Cutch Brown, all brands, | Cardinal R, G, |
| Dark Brown, all brands, | Maroon, all brands, |
| Bismark Brown, all brands, | Safranine, all brands, |

Safranine Scarlet. all brands,
 Brilliant Safranine. all brands,
 Methyl Violet. all brands,
 Violet Crystals, all brands,
 Ethyl Violet, all brands,
 New Violet, all brands,
 Victoria Blue, all brands,
 Methylene Blue, all brands,

Thionine Blue GO,
 Marine Blue, all brands,
 Methylene Dark Blue,
 Malachite Green, all brands,
 Brilliant Green, all brands,
 Coal Black, all brands,
 Rosazeine, all brands.

Acid Colours.

Acid Magenta O, extra,
 Soluble Blue, all brands,
 Bleu de Lyon O, R, 2R,
 Guernsey Blue O,
 Cotton Blue, all brands,
 Pure Blue O. conc., LW, 9209,
 Cotton Light Blue conc., O,
 China Blue, all brands,
 Full Blue MZ,
 Purple Blue O, double conc.,
 Fast Pure Yellow CHO,
 Naphtol Yellow. all brands,
 Azo Yellow, all brands,
 Victoria Yellow, all brands,
 Metanil Yellow, all brands,
 Flavazine T,
 Flavazine S, L, 3GL,
 Orange, all brands,
 Paper Orange, all brands,
 Fast Brown, all brands,
 Opal Blue superior soluble,

Methyl Blue for Cotton MLB,
 Emperor Blue O,
 Paper Blue, all brands,
 Patent Blue, all brands,
 Fast Blue extra green shade,
 O soluble in water,
 Fast Acid Blue R, R conc.,
 Acid Violet, all brands,
 Fast Acid Violet, all brands,
 Acid Green, all brands,
 Paper Scarlet, all brands,
 Brilliant Croceine, all brands,
 Fast Red, all brands,
 Carbon Black B,
 Nigrosine, all brands,
 Janus Blue, R, G, B,
 Janus Green B, G,
 Janus Black O, I, II,
 Janus Brown B, R,
 Janus Red B,
 Janus Yellow R, G.

Direct Colours.

Dianil Yellow R, RR, G, 3G,
 Dianil Pure Yellow HS,
 Oxydianil Yellow O, conc.,
 Autophenine O, conc.,
 Primuline O,
 Dianil Fast Scarlet, all brands,
 Dianil Scarlet 2R,
 Dianil Crimson B,
 Dianil Brown, all brands,
 Dianil Fast Brown B, R,
 Dianil Copper Brown O,
 Dianil Claret Red B, G,
 Dianil Pink BD,
 Dianil Blue, all brands,
 Dianil Dark Blue R, 3R,

Dianil Orange R, G,
 Toluylene Orange R, R conc.,
 Dianil Red R, 4B,
 Dianil Fast Red PH,
 Brilliant Dianil Red R,
 Dianil Green, all brands,
 Dianil Dark Green B,
 Dianil Violet H,
 Dianil Magenta O,
 Jet Black B. P. R. all brands,
 Dianil Jet Black, all brands,
 Direct Black II,
 Dianil Black, all brands,
 Patent Dianil Black, all brands.

II. IMMERSING THE FINISHED, UNSIZED OR SLIGHTLY SIZED PAPER.

The immersion is carried out in special machines, seldom by hand. The paper is passed through an aqueous solution of the dyestuff, squeezed and dried. In this manner bright full shades are obtained, such as cannot be produced by dyeing in the pulp. When using this method, only the most soluble colours must be used. Acids, Alkalis, Acids, Glue, Starch paste, Gum, Borax etc. can be made to the dyestuff solutions, in order to impart certain properties to the finished paper.

III. DYEING THE SURFACE OF THE PAPER.

The dyestuff solutions are applied to the surface of the paper either by means of printing rollers or with brushes or felt.

For mixed shades, only dyestuffs belonging to the same group can be employed.

The following colours are suitable for both processes :

Basic Colours.

Auramine, all brands,
Flavophosphine, all brands,
Chrysoidine, all brands,
Vesuvine, all brands,
Dark Brown, all brands,
Magenta, all brands,
Cerise, all brands,
Maroon, all brands,
New Magenta, all brands,
Brilliant Green, all brands,
Coal Black, all brands,
Safranine, all brands,

Safranine Scarlet, all brands,
Brilliant Safranine, all brands,
Methyl Violet, all brands,
Violet Crystals, all brands,
Ethyl Violet, all brands,
Victoria Blue, all brands,
Methylene Blue, all brands,
Marine Blue, all brands,
Malachite Green, all brands,
Jute Black, all brands,
Rosazeine, all brands.

Acid Colours.

Acid Magenta O, extra,
Soluble Blue, all brands,
Bleu de Lyon O, R, 2R,
Guernsey Blue O,
Cotton Blue, all brands,
Cotton Light Blue conc., O,
Pure Blue O, conc., LW, 9209,
China Blue, all brands,
Full Blue MZ,
Purple Blue O, double conc.,
Opal Blue superior soluble
Flavazine S, L, 3GL,
Azo Yellow, all brands,
Victoria Yellow, all brands,
Metanil Yellow, all brands,

Fast Orange, all brands,
Orange, all brands,
Paper Orange, all brands,
Fast Brown, all brands,
Paper Scarlet, all brands,
Brilliant Croceine, all brands,
Emperor Blue O,
Fast Red, all brands,
Alkaline Blue, all brands,
Opal Blue red shade, blue shade,
Conc. Cotton Blue R, No. 1,
No. 2,
Paper Blue, all brands,
Laundry Blue, all brands,
Acid Violet, all brands,

| | |
|-------------------------------|---------------------------------------|
| Fast Acid Violet, all brands, | Brilliant Fixing Scarlet, all brands, |
| Acid Green, all brands. | Scarlet, all brands, |
| Patent Blue, all brands, | Erythrosine, all brands, |
| Fast Acid Blue R, R conc., | Brilliant Orange, all brands, |
| Fast Blue extra green shade, | Eosine, all brands, |
| O soluble in water, | Erythrosine, all brands, |
| Carbon Black B, | Phloxine, all brands, |
| Fast Pure Yellow CHO. | Rose Bengale, |
| Naphtol Yellow, all brands, | Janus Blue. R, G, B, |
| Flavazine T, | Janus Green B, G, |
| Nigrosine, all brands, | Janus Black O, I, II, |
| Victoria Scarlet, all brands, | Janus Brown B, R, |
| Paper Scarlet, all brands, | Janus Red B, |
| Paper Yellow, all brands, | Janus Yellow R, G. |

A series of special methods for applying colours to paper and pulp, producing special papers, have been worked out by us and are protected by patents in the various countries:

- a) Ingrain papers.
- b) Melange papers, Triumph material or Dialana papers.
- c) Phidias or Marmorella papers.
- d) Trachyte papers.
- e) Mottled papers.
- f) Discharge papers.
- g) Syenite papers.
- h) Relief papers.
- i) Veined papers.
- k) Cirrus papers.
- l) Marble-silk papers.
- m) Ombré papers.

a) Ingrain papers.

These are papers with a melange effect produced by black wool fibres. The black wool fibres are dyed with colours which are fast to water, and then added to the already ground and dyed paper material in the beating machine.

b) Triumph material or Dialana Papers.

This paper shows a pronounced melange effect, which is produced by dyed cellulose. The effect fibres are dyed with Dianil colours, with the addition of common salt or Glauber's salt and soda. The required quantity is then worked in with the white or coloured paper material contained in the beating machine. Various coloured fibres and Jute, Cotton, Ramie fibres, also Sawdust etc can be used for producing these melange effects.

c) Phidias or Marmorella Papers.

These papers illustrate cloudy effects and are produced as follows: Dyestuff solutions are allowed to flow very slowly into the paper material when already on the sieve, viz: in the final stage of manufacture; they are in this way so divided throughout the mass as to produce a certain cloudy appearance.

d) Trachyte Papers.

These papers imitate the coloured veins in certain stones. Their production is possible by an alteration in the paper machine, which allows of one or more kinds of coloured material other than the bulk, being affixed to the forming paper ribbon, running of course in irregular longitudinal streaks or veins.

e) Mottled Papers.

The production of mottled papers is carried out on a specially constructed machine, which brings flakes of other coloured paper material on to the paper on the sieve.

f) Discharge Papers.

Bisulphite and Hydrosulphite do not affect the quality of the paper, and consequently they can be used for discharging dyed papers. The discharging agents are applied to the dyed material while still moist, either by means of a printing machine or by spraying. The paper is then dried over cylinders when the discharging action takes place. Dischargeable dyestuffs are Pure Blue, Methyl Violet, New Magenta, Vesuvine, Chrysoidine, Victoria Blue, Brilliant Green, Metanil Yellow, Orange, Acid Violet, Alkaline Blue, Soluble Blue. Further effects can be obtained by dyeing simultaneously with dischargeable and also with undischageable colours.

g) Syenite Papers.

These are produced by spraying the paper with one or more dyestuff solutions at suitable places when passing over the sieve.

h) Relief Papers.

The method of dyeing gives these papers the appearance of a partly raised surface. The surface of the paper ribbon while still wet, is stiffened slightly in suitable places by means of an engraved roller, and then from the sides and at a sharp angle, one or more dyestuff solutions are sprayed on to the uneven surface of the paper. It is clear that the raised portions get dyed in this way more deeply, than the lower portions. In passing finally through the rollers, these unevennesses are smoothed out again but the relief effect is still maintained.

i) Veined Papers.

These papers show effects similar to the grains of wood. They are produced as follows: The paper is passed through a dye trough over one or more rollers under water. Into this trough dyestuff solutions drop at regular intervals and the paper takes up this colour. A continuous supply of water is maintained, whereby the peculiar division of the dye solutions is obtained.

k) Cirrus Papers.

The Cirrus papers show a certain regular marble appearance. They are produced by applying one or more dyestuff solutions to the coarse paper while still on the sieve, by means of cloths or felt.

l) Marble-Silk Papers.

These are produced according to a new process, by means of a specially constructed spraying arrangement.

m) Ombré Papers.

These are produced on a machine specially constructed by us for this purpose.

FLOWERS AND GRASSES.

Flowers, leaves, grasses, palm-leaves etc. are dyed at the boil in a neutral or weak acid bath. Care must be taken not to let the bath boil too violently, otherwise the material suffers or is destroyed.

After dyeing they must be carefully washed, and dried at not too high a temperature.

DYESTUFFS WHICH DYE IN A NEUTRAL BATH.

| | |
|-------------------------------------|-------------------------------|
| Auramine conc., O, I, II, | Methyl Violet, all brands, |
| Chrysoidine A cryst., C cryst., | Malachite Green cryst. extra, |
| C extra crystals, | Brilliant Green cryst. extra, |
| Vesuvine 4BG conc, 3R superior, | Methylene Blue. all brands, |
| Phosphine extra O, | Methylene Green, all brands, |
| Leather Yellow O, G, GG, | Coal Black II, |
| Leather Red O, G, | New Fast Blue 3R cryst. |
| Leather Brown O, | Fast Cotton Blue R, BB, |
| Flavophosphine, all brands, | Janus Yellow G, R, |
| Azophosphine GO, BRO, | Janus Red B, |
| Magenta, large cryst. small cryst., | Janus Brown R, |
| Cerise G, R, | Janus Blue G, B, R, |
| Grenadine O, R, RR, | Janus Green G, B, |
| Russia Red D, 5001, | Janus Black O, I, II. |
| Maroon O, extra, | Cardinal G, R, |
| Rosazeine Scarlet G extra, | New Magenta O, |
| Methylene Violet 3RA extra, | Safranine conc., O, |
| RAA, BN, | Rosazeine, all brands, |
| Fluorescent Violet B conc., | |

THE FOLLOWING DYESTUFFS ARE DYED IN AN ACETIC ACID BATH.

| | |
|------------------------|----------------------------|
| Chinoline Yellow O, | Bleu de Lyon RR, conc., |
| Naphtol Yellow SL, | Cotton Blue No. 2, |
| Acid Magenta extra, | China Blue No. 2, |
| Orseiline R, B, | Acid Green conc., |
| Acid Cerise O, | Naphtalene Green V, conc., |
| Acid Maroon O, | Patent Blue V, A. |
| Opal blue, blue shade, | |

VEGETABLE IVORY BUTTONS.

The buttons are boiled for 1—2 hours, and then dyed in a neutral bath for 1—2 hours. For dark shades, the buttons are mordanted with Tannin and Tartar Emetic.

The following colours are suitable for button dyeing:

| | |
|-------------------------------------|-------------------------------|
| Auramine conc., O, I, II, | New Magenta O, |
| Chrysoidine A cryst., C cryst., | Safranine conc., O, |
| C extra cryst., | Methylene Violet 3RA extra, |
| Vesuvine 4BG conc. 3R superior, | RRA, BN, |
| Phosphine extra, O, | Malachite Green cryst. extra, |
| Leather Yellow O, G, | Brilliant Green cryst extra, |
| Leather Brown O. | Methyl Violet 2B chem. pure, |
| Magenta small cryst., large cryst., | 6B chem. pure. |
| Cerise G, R, | Methylene Blue, all brands, |
| Grenadine O, R, RR, | Methylene Green, all brands, |
| Maroon O, extra, | New Fast Blue 3R crystals, |
| Cardinal G, R, | Fast Cotton Blue R, BB, 4B, |
| Rosazeine. all brands, | Methylene Grey O, NF, D, NFN. |
| Rosazeine Scarlet G extra, | |

LEATHER DYEING.

A. THE DYEING OF BARK AND SUMACH TANNED LEATHER.

The most important factor in the dyeing of bark and sumach tanned leather is the proper preparatory treatment of the material.

Whether dyed in the trough, barrel, or on the table, the leather must be milled for at least 3—4 hours before dyeing, in order to cleanse it, and to make it pliable and capable of taking up dyestuffs.

In order to obtain a good result, the leather after being sufficiently softened is again milled with sumach solution in a milling tub or in another kind of revolving apparatus. The material is then well washed, so as to remove any mechanically adhering tanning agent from the hide.

Specky and old leather must be soured with Sulphuric acid before milling. The milling tub is filled with cold water to which is added 1 part of Sulphuric acid 168° Tw. per 100 parts of water, and the material is treated for about 20 minutes. The dirty liquor is then run off, and the leather well washed. In most cases, by this treatment the leather becomes quite clean. Very fatty leathers however easily turn specky and dirty after dyeing. In order to prevent this defect they are first treated with Benzine to remove the fat. For leathers that are not too fatty, a treatment with water containing an addition of 1—2 parts Borax or Soda per 1000 parts is sufficient. After milling, the goods are well rinsed, and again milled for half an hour in a liquor containing $\frac{3}{4}$ of a pint Lactic acid per 20 gallons.

DYEING IN THE TROUGH.

(Dipping process.)

Two well-milled skins are stretched out, and laid one upon the other with the rough sides together, so that they perfectly cover each other. They are then entered into the dye liquor at 113—122° F; for two medium sized skins about 1 gallon of liquor is used. The water employed for dyeing must be as soft as possible; hard water must be corrected with Acetic acid.

As a rule, light shades are finished in one bath; medium or dark shades are first dyed with Acid colours and then topped with Basic colours in a second bath. After dyeing the skins are rinsed, stretched and dried.

DYEING IN A REVOLVING APPARATUS.

The apparatus is filled with the necessary amount of water at 122–132° F., the apparatus set in motion, and the milled leather entered, after which the dyestuff solution is added gradually. Light shades are finished in one bath, but medium and dark shades are first dyed with acid or direct colours and then topped with Basic colours. The goods are dyed for $\frac{1}{2}$ an hour, rinsed, stretched and dried.

DYEING IN THE MILLING TUB.

The well milled leather is entered into the milling tub, which is then closed and set in motion. Dye liquor of 120–140° F. is then run in through the hollow axle. For 200 lbs. of leather (nett weight of dressed leather) about 26 gallons of liquor are used. As in the above mentioned methods so also in this case, the goods can be first dyed with Acid or Direct colours and then topped with Basic colours.

DYEING BY BRUSHING ON THE TABLE.

This method is used for heavy qualities of leather, such as Vachettes, cow hides, horse leather etc.; other leathers are only dyed by this method when the rough side is to remain undyed. Dyeing with the brush is most frequently used for blacks.

In order to obtain even shades the grain of the leather is first washed with a dilute solution of Lactic acid ($\frac{1}{2}$ —1 part per 1000 of water), after which the dyestuff solution, containing 5–10 parts of colour per 1000, is applied at 86–104° F. When dyeing light shades the leather is first brushed with very dilute solutions, dried, and again brushed with stronger solutions. Even shades can likewise be obtained by first grounding with Bichrome, Acetate of Iron, etc. By this method also, the leather can be first dyed with Acid and Direct colours and then topped with Basic colours.

Lists of dyestuffs suitable for dyeing bark and sumach tanned leather:

1. Dyestuffs

which dye bark-tanned leather in a neutral bath.

| | |
|-------------------------------------|------------------------------|
| Auramine conc., O, I, II, | Cerise G, R, |
| Chrysoidine A cryst., C cryst., | Grenadine O, R, RR, |
| C extra crystals, | Jute Red D, 5001, |
| Vesuvine 4BG conc., 3R super., | Maroon O, extra, |
| Brown A, | Cardinal G, R, |
| Saffian Red O, | New Magenta O, |
| Azophosphine GO, BRO, | Safranine conc., O, |
| Flavophosphine, all brands, | Methyl Violet 2B chem. pure, |
| Magenta large cryst., small cryst., | 6B chem. pure, |

| | |
|---------------------------------|--------------------------------|
| Phosphine extra, O, | Fast Blue for Cotton R extra, |
| Leather Yellow O, G, GG, | BB, 4B, |
| Leather Red O, R, G, | Methylene Grey O, NFD, |
| Leather Brown O, | Janus Yellow G, R, |
| Malachite Green crystals extra, | Janus Red B, |
| Brilliant Green crystals extra, | Janus Brown R, |
| Methylene Blue, all brands, | Janus Blue B, |
| Methylene Green, all brands, | Janus Green G, |
| New Fast Blue 3R crystals, | Janus Black I, |
| | Leather Black T, TM, 5068, BB. |

2. Dyestuffs

which are applied in a weak Sulphuric acid bath.

| | |
|---------------------------|----------------------------------|
| Acid Magenta extra, | Acid Green conc, |
| Orseiline R, B, | Patent Blue V, A, |
| Acid Cerise O, | Fast Blue O, R, 5B, |
| Acid Maroon O, | Nigrosine No. 1, 4, D spirit, |
| Bleu de Lyon RR, | Azo Yellow conc., |
| Pure Blue O, conc., | Fast Brown O, yellow shade, |
| Victoria Yellow conc., | Acid Leather Brown O and OO, |
| New Yellow H, | Scarlet G, R, RR, 3R, 4R, 5R, |
| Acid Phosphine G, | 6R, B extra, |
| Azoflavine H, | Brilliant Croceine yellow shade, |
| Orange No. 2, No. 4, G, | blue shade, R, B, 2B, 3B, 5B, |
| Brilliant Orange G, O, R, | Fast Red O, |
| Conc. Cotton Blue No. 2, | Claret Red G, B, R. |
| China Blue No. 2, | |

3 Dyestuffs

applicable in a weak Acetic acid bath.

| | |
|----------------------------|------------------------|
| Eosine extra AG, extra BB, | Rosazeine O, 4G, 6G, |
| Phloxine O, G, 5B, | Acid Alizarine Grey G, |
| Red Y, YB, | Leather Grey A. |

B. THE DYEING OF CHROME LEATHER.

This can be carried out according to the above mentioned methods. After tanning, the chrome leather must be neutralised with Borax, Chalk, or Ammonia in order to obtain even shades and a soft feel. The dyeing operation is generally carried out in the milling tub.

Dyeing with Acid colours in the milling Tub.

The neutralised skins are put into the tub, which is then closed and set in motion. For every 200 lbs. of chrome leather (nett weight of dressed leather) 2-4 lbs. of Sumach extract 42° Tw. diluted with 24 gallons of water, are run into the tub through the hollow axle.

The leather is treated for $\frac{1}{2}$ an hour, washed, and immediately dyed with Acid colours with the addition of Acetic or Sulphuric acid. For 200 lbs. of chrome leather (net weight of dressed leather) the well prepared dyestuff solution is diluted to 24—26 gallons, heated to 131–140° F. and run into the tub through the hollow axle. After 20 minutes $\frac{1}{6}$ — $\frac{1}{3}$ pint Acetic acid or the corresponding quantity of Sulphuric acid is added, and the material treated for 20—25 minutes longer. After running off the dye liquor the leather is rinsed and oiled for 30—45 minutes at 96—104° F. with 3—4% Yellow of egg and 3% Monopole soap, or with an emulsion of 3% Neatsfoot oil and 2 $\frac{1}{2}$ % Olive oil soap. The leather is again rinsed for a short time, stretched by hand or machine, dried and dressed.

Basic colours are dyed according to the same method, but double the amount of Sumach extract is required. After treating the leather in the Sumach bath, it is passed through a bath containing 1 $\frac{1}{2}$ —2 lbs. of Tartar emetic, rinsed, and dyed as with Acid colours. When dyeing chrome leather with Acid colours which are to be topped with Basic colours afterwards, it is first treated in the milling tub with the addition of Acetic or Sulphuric acid; after 20—25 minutes 2—4 lbs. of Sumach extract 42° Tw. are added, and the goods worked for a further 20 minutes. It is then rinsed with water and dyed with Basic colours in a fresh bath; the leather is finally rinsed and oiled.

Dyeing with Direct Colours.

Direct colours can be employed in dyeing by any of the above mentioned methods. A little Acetic acid is added to the dyebath and the dyeing operation carried out at 130—140° F.

Black on Chrome Leather.

Black is the principal colour in chrome leather dyeing; the following four special recipes for its production are to be recommended:

1. With Brilliant Chrome Leather Black extra and Leather Black C.

The dye liquor is prepared, for 200 lbs. Chrome Leather (net weight of dressed leather) with 2—3 lbs. of Colour dissolved in 24 gallons of water. The neutralised leather is treated in this liquor for about $\frac{1}{2}$ an hour at 130—140° F., after which 4 lbs. of Palm leaf extract, or any other tannin extract, dissolved in 4 gallons of water, is added, and the material treated for a further $\frac{1}{2}$ hour. To perfectly fix the colour $\frac{1}{2}$ pint of Acetic acid is finally added to the dyebath. The leather is then oiled for $\frac{3}{4}$ of an hour with 3% Yellow of egg, 2% Olive oil soap, 1 $\frac{1}{2}$ % Neatsfoot oil and 1 $\frac{1}{2}$ % Borax at 104° F. After repeated washing the goods are stretched, dried and dressed. The Leather Black brands possess the property of dyeing the rough side blue-black, and the grain deep black, with a bluish-red appearance. By adding 0.25% of Chrome Leather Violet O to the dyebath the rough side is dyed violet.

2. Dyeing with Carbon Black B

(topped with Leather Black T, TM, No. 5068).

The neutralised leather is placed in the barrel containing, per 200 lbs. leather (dry weight of the dressed skins) 3 lbs. Carbon Black B in 24 gallons of water. It is treated for 20 minutes at 140–150° F., the colour being fixed by finally adding $\frac{1}{10}$ to $\frac{1}{6}$ pint of Acetic acid. After running for a further 10 minutes, according to whether the black is to have a greenish or reddish tone, $\frac{1}{4}$ –1 lb. of Leather Black T, TM, or No. 5068 is added, and the goods treated for $\frac{1}{4}$ of an hour longer. Brand "T" is the green shade and brand No. 5068 is the red shade. The goods are then rinsed and oiled.

3. Dyeing with Leather Black MD after oiling.

The neutralised goods are oiled with the following emulsion: 4 lbs. Yellow of Egg, 2 $\frac{1}{2}$ lbs. Olive Oil soap, 3 lbs. Neatsfoot oil, $\frac{1}{8}$ pint Ammonia and 1 $\frac{1}{2}$ ozs. of Calcined soda, for 200 lbs. of leather (dry weight of the dressed skins), at 113° F for $\frac{1}{4}$ of an hour. The goods are then drawn over the trestle and allowed to lie for 4–5 hours, so that the fat combines with the leather throughout. The goods are then dyed in the barrel with 3–4 lbs. of Leather Black MD in 24 gallons of liquor, for $\frac{3}{4}$ of an hour at 130–140° F.

To complete the fixation of the dyestuff, $\frac{1}{8}$ – $\frac{1}{4}$ gill of Acetic acid is finally added. After rinsing, the skins are stretched, slightly oiled, dried and dressed.

4. Dyeing with Carbon Black B and Leather Black 5068 on the table.

The neutralised goods are first brush dyed with a 1% solution of Carbon Black B, at 120° F, after which they are well stretched, they are then again brushed over with a $\frac{1}{8}$ % solution of Leather Black No. 5068 at 120° F., and finally rinsed, stretched, oiled by hand on the table, dried and dressed.

5. Oiling and Dyeing of Chromed leather in one Bath.

By means of this process (pat. applied for) a saving of time and labour is effected; the finished leather, moreover, is more beautiful on account of the short treatment and the oil addition.

The perfectly neutralised chromed leather is treated in the barrel for $\frac{1}{2}$ an hour at 120–140° F., in an emulsion containing, per 200 lbs. of leather:

4 lbs. Olive Oil soap
3 „ Degras (Fish oil)
3 „ Neatsfoot oil
3 ozs. Calcined soda

2 lbs. of Logwood extract are added to the bath, the goods worked for 20–30 minutes longer, and then 1 lb. Carbon Black B and a little Acetic acid are added. The barrel is run for a further 20 minutes, and finally, 1 $\frac{1}{2}$ lbs. of Brilliant Chrome Leather Black extra are added.

After treating the leather for another $\frac{1}{2}$ hr. it is rinsed, stretched, oiled on the table, dried and dressed.

List of colours suitable for dyeing Chrome Leather:

1. Colours which dye chromed leather in a weak Sulphuric Acid Bath.

| | |
|-------------------------------|----------------------------------|
| Acid Magenta extra, | Victoria Yellow conc., |
| Orseilline R, B, | New Yellow H, |
| Acid Cerise O, | Acid Phosphine G, |
| Acid Maroon O, | Orange No 2, No. 4, G, |
| Bleu de Lyon RR, | Brilliant Orange O, G, R, |
| Pure Blue O, conc., | Fast Brown O, yellow shade, |
| Conc. Cotton Blue No. 2 | Acid Leather Brown O, OO, |
| China Blue No. 2, | Scarlet G, R-6R, B extra, |
| Acid Green conc., | Brilliant Croceine yellow shade, |
| Patent Blue V, A, | blue shade, R, B-5B, |
| Fast Blue O, R. 5B, | Fast Red O, |
| Nigrosine No. 1, 4, D spirit. | Claret Red G, B, R, |
| Azo Yellow conc. | Carbon Black B. |

2. Colours for a weak Acetic Acid Bath.

| | |
|--------------------|----------------------------|
| Rosazeine O, 4G, | Eosine extra AG, extra BB, |
| Red Y, YB, | Acid Alizarine Grey G. |
| Phloxine O, G, 5B, | |

3. Colours for an Alkaline or an ordinary Salt Bath.

| | |
|--------------------------|--------------------------------|
| Dianil Yellow 3G, R, 2R, | Dianil Blue G, B, R, |
| Dianil Direct Yellow S, | Chrome Leather Brown No.1-4, |
| Dianil Orange G. | Leather Black C, |
| Dianil Brown R, | Brilliant Chrome Leather Black |
| | extra, extra conc. |

4. Colours for a neutral Bath.

| | |
|----------------------------------|-------------------------------|
| Auramine conc., O, I, II, | Magenta small crystals, large |
| Chrysoidine A cryst., C cryst., | crystals, |
| C extra crystals, | Cerise G, R, |
| Vesuvine 4BG conc., 3R superior, | Grenadine O, R, RR, |
| Phosphine extra, O, | Maroon O, extra, |
| Leather Yellow O, G, GG, | Cardinal G, R, |
| Flavophosphine, all brands, | Russia Red D, 5001, |
| Azophosphine GO, BRO, | New Magenta O, |
| Leather Red O, G, R, | Safranine conc., O, |
| Leather Brown O, | Methylene Violet 2B, 6B, che- |
| Brown A, | mically pure, |
| Saffian Red O, | Malachite Green cryst. extra, |

Brilliant Green cryst. extra,
Methylene Blue, all brands,
Methylene Green, all brands,
New Fast Blue 3R crystals,
Fast Blue for Cotton R extra
BB, 4B,
Janus Yellow G, R,
Janus Brown R,

Janus Red B,
Janus Blue B,
Janus Green G,
Janus Black I,
Leather Black T, TM, 5068, BB,
Patent Chrome Leather Black B,
Brilliant Chrome Leather Black
extra. extra conc.

C. THE DYEING OF ALUM TANNED LEATHER.

Alum tanned leathers are first freed from excess of Alum by repeated rinsing, after which they are dyed in pairs in the trough, or in the barrel, or on the table with the brush at 113° F.

1. Dyestuffs

which dye Alum Tanned Leather in a Neutral Bath.

Auramine conc, O, I, II,
Chrysoidine A cryst., C cryst., C
extra cryst.,
Vesuvine 4BG conc., 3R superior,
Phosphine extra, O,
Leather Yellow O, G, GG,
Leather Red O, G, R,
Leather Brown O,
Brown A,
Saffian Red O,
Flavophosphine, all brands,
Azophosphine GO, BRO,
Magenta small cryst., large cryst.,
Cerise G, R,
Grenadine O, R, RR,
Russia Red D, 5001,
Mauve O, extra,
Cardinal G, R,
Safranine conc., O,

New Magenta O,
Methyl Violet 2B chem pure,
5B chem. pure,
Malachite Green cryst. extra,
Brilliant Green cryst. extra,
Methylene Blue, all brands,
Methylene Green, all brands,
New Fast Blue 3R crystals,
Fast Cotton Blue R extra, BB,
4B,
Methylene Grey O, NFD, NFN,
Janus Yellow G, R.
Janus Red B,
Janus Brown R,
Janus Blue B,
Janus Green G,
Janus Black I,
Leather Black T, TM, 5068, BB.

2. Colours for a weak Sulphuric acid Bath.

Acid Magenta extra,
Orseiline R, B,
Acid Maroon O,
Acid Cerise O,
Bleu de Lyon RR,
Pure Blue conc., O,

Conc. Cotton Blue No. 2,
China Blue No. 2,
Acid Green conc.,
Patent Blue V, A,
Fast Blue O, R, 5B,
Nigrosine No. I, 4. D spirit.

| | |
|-----------------------------|---------------------------------|
| Azo Yellow conc. | Scarlet G. R, RR, 3R, 4R, 5R, |
| Victoria Yellow conc, | 6R, B extra, |
| New Yellow H, | Brill. C. yellow shade, |
| Orange No. 2. 4, G, | R B 2B 3B, 5B. |
| Brilliant Orange G, O, R, | Fast Red O, |
| Fast Brown O, yellow shade, | Claret Red G. B. R. |
| Acid Leather Brown O, OO, | |

3. Colours for a weak Acetic acid Bath.

| | |
|------------------|----------------------------|
| Rosazeine O, 4G, | Phloxine O, G, 5B, |
| Red Y, YB, | Eosine extra AG, extra BB. |

FUR DYEING.

In addition to a few Basic and Acid colours, the principal dyestuffs employed in fur dyeing, are the Nako colours. These are products which are converted into coloured compounds on the fur by oxidation with Hydrogen Peroxide. In comparison to the natural dyestuffs, which formerly were the only colours employed for fur dyeing, the Nako colours possess this advantage, that the dyeing operation is simplified and the time shortened. They can be applied to the fur either by the brushing or dipping process, or by a combination of these methods.

The removal of the fat and grease from the fur ("killing") is best effected by means of Lime. The fur is treated for 2 hours in Lime-water (10 parts of Lime per 1000), or it is brushed over with Milk of Lime. Similarly, other alkaline substances such as Phosphate of Soda etc. can be employed, but the brightest shades are obtained by using Lime. If Soda is used, the material is treated similarly, in a liquor containing 10 parts Soda per 1000 parts of water.

After "killing" the fur is well washed in water containing a little Acetic acid, and then thoroughly rinsed.

For light shades, the fur, prepared as above described, is placed direct into the dyestuff solution. For medium and dark shades it must first be mordanted; this is carried out by immersing the skins for 18-24 hours in the mordant baths; they are then washed. Mordant solutions may also be brushed on, but the strength of the mordant liquor must be doubled in that case. The following substances are used as mordants: Potassium Bichromate, Copper Sulphate, Ferrous Sulphate and Tartar. The necessary quantities of these salts, and their influence on the shade, are shown in the following table.

According to the dyestuffs employed, and their method of application, the fur is "killed" with Lime or Soda. Lime is used especially when dyeing with the following colours:

Nako Yellow O,
Nako Red O.
Nako Black OP, DB, *
Nako Brown D, DD, GG on Copper and Iron mordant.

The fur is "killed" with Soda when using:

Nako Brown PS, P,
Nako Brown D, DD, on Chrome mordant.

| Dyestuff | Bichrome | Copper Sulphate | Ferrous Sulphate | Tartar | Acetic Acid 50% | Shade |
|---------------|----------------|-----------------|------------------|--------|-----------------|--------------|
| | per 1000 parts | | | | | |
| Nako Brown B | 2.5 | 0.25 | — | 1.5 | — | grey brown |
| Nako Brown P | 2.5 | 0.25 | — | 1.5 | — | brown |
| Nako Brown PS | 2.5 | 0.25 | — | 1.5 | — | brown |
| Nako Brown D | 2.5 | 0.25 | — | 1.5 | — | dark brown |
| Nako Brown DD | 2.5 | 0.25 | — | 1.5 | — | dark brown |
| Nako Brown G | 2.5 | 0.25 | — | 1.5 | — | brown |
| Nako Brown GG | 2.5 | 0.25 | — | 1.5 | — | yellow brown |
| Nako Brown BR | 2.5 | 0.25 | — | 1.5 | — | brown |
| Nako Yellow O | 2.5 | 0.25 | — | 1.5 | — | yellow |
| Nako Black DB | 2.5 | 0.25 | — | 1.5 | — | dark brown |
| Nako Black DB | — | 2 | 2 | — | 2 | black |
| Nako Brown D | — | 2 | 2 | — | 2 | black |
| Nako Brown DD | — | 2 | 2 | — | 2 | black |
| Nako Brown BR | — | 2 | 2 | — | 2 | brown |
| Nako Red O | — | 2-4 | — | — | 2 | red brown |
| Nako Brown P | — | — | 4 | — | 2 | fancy brown |
| Nako Brown PS | — | — | 4 | — | 2 | fancy brown |
| Nako Red O | — | — | 4 | — | — | fancy green |
| Nako Black OP | — | 2 | 2 | — | 2 | black |
| Nako Brown B | — | 4 | — | — | 2 | grey brown |

Nako Brown GG, P, PS, B and BR

are dyed on a Chrome mordant, producing yellow browns; on an Iron mordant they produce fancy brown shades.

Nako Brown D and DD

produce dark reddish browns on a Chrome mordant; the brown produced with the brand DD is somewhat more violet in shade than the D brand. With a mixed Copper and Iron mordant they produce blue blacks. If dyed with the addition of Hydrogen Peroxide, a black can be obtained with Nako Brown D without first mordanting. Nako Brown D is also used for dyeing the tips of furs; by brushing on weak solutions, browns are obtained, whilst stronger solutions or repeated application yield black tips.

Nako Brown AN

is dyed on clean unmordanted fur, and produces a dark brown. It can also be dyed in combination with other Nako colours on any mordant

Nako Yellow O

produces yellow tobacco shades when dyed with Hydrogen Peroxide and yellow browns when dyed on Chrome and Copper mordants. It can also be used as a shading colour for brown.

Nako Red O

produces a red brown on a Copper mordant, and a fancy green when dyed on an Iron mordant.

Nako Black DB

produces a deep black with a bluish hue when dyed on a Copper-Iron mordant; on a Chrome-Copper mordant the shade is somewhat redder.

Nako Black OP

is best dyed on a Copper-Iron mordant, when a deep black with a violet hue is obtained.

The dyeing of

Nako Brown, Nako Yellow and Nako Red

is carried out as follows:

The dyestuff is dissolved in cold water, and the mordanted fur placed in this solution for 2 hours. To 1 part (1 gm) of colour used, are now added 10 parts (10 cc's) of Hydrogen Peroxide 3%, and the material dyed for about 8 hours.

When dyeing unmordanted furs, double the quantity of Hydrogen Peroxide is added to the dyebath.

Nako Red is dyed without Hydrogen Peroxide

Nako Brown PS is most suitably dyed with the addition of 60 parts of Ammonia 20% per 100 parts of dyestuff. In this way deeper shades are obtained.

Black on fur is dyed as follows:

The dye liquor is prepared with 4 parts Borax per 1000 parts of water, and to this solution are added: 10-12 parts of Nako Black OP (paste) per 1000 parts. The mordanted fur is then entered, moved about for $\frac{1}{2}$ an hour, and allowed to remain in the bath 12 hours. Hydrogen Peroxide 3% is then added in the proportion of 30-40 parts per 1000 parts of dyebath, and the goods again dyed for 12 hours.

When using Nako Black DB, the dyebath is prepared with 4 parts of dyestuff per 1000. The fur is entered into the cold dyebath, and after 2 hours, 40 parts of Hydrogen Peroxide 3% per 1000 parts of dye liquor are added, and the dyeing operation continued for about 24 hours. The fur is then well rinsed, dried, cleansed and finished.

Besides the Nako colours, the following wool colours are also suitable for fur dyeing, since they can be applied at a low temperature:

| | |
|------------------------|------------------------------|
| Acid Alizarine Grey G, | Victoria Yellow conc , |
| Chrome Brown, | Rosazeine O, B, |
| Fur Yellow, | Fast Red O, |
| Azo Yellow conc., | Azo Acid Red B, |
| Orange 2, | Alizarine Direct Blue EB, B. |

These dyestuffs are dissolved in boiling water, but are dyed in a cold bath for 10-12 hours.

FEATHER DYEING.

1. Colours which dye in a neutral bath.

Before dyeing, the feathers are well cleansed with Soda and then rinsed. They are dyed at the boil and dried in revolving drums.

| | |
|-----------------------------------|-------------------------------|
| Auramine conc., O, I, II, | Methylene Violet 3RA extra, |
| Chrysoidine A cryst, C cryst., C | RR, BN, |
| extra crystals, | Methyl Violet, all brands, |
| Vesuvine 4BG, conc., 3R super., | Malachite Green cryst. extra, |
| Phosphine extra, O, | Brilliant Green cryst. extra, |
| Leather Yellow O, G, G-G, | Methylene Blue, all brands, |
| Leather Red O, G, R, | Methylene Green, all brands, |
| Leather Brown O, | Methylene Grey O, NFS, |
| Saffian Red O, | Coal Black II, |
| Azophosphine GO, BRO, | New Fast Blue 3R crystals, |
| Magenta sm. cryst., large cryst., | Fast Blue for Cotton R extra, |
| Cerise G, R, | BB, 4B, |
| Grenadine O. R. RR, | Janus Yellow G, R, |
| Russia Red D. 5001, | Janus Red B, |
| Maroon O. extra. | Janus Brown R, |
| Cardinal G. R, | Janus Blue G, B, R, |
| New Magenta O. | Janus Green G, B, |
| Safranine conc., O, AN extra, | Janus Black O, I, II |

2. Colours which dye in a Sulphuric Acid bath.

| | |
|----------------------------|----------------------------------|
| Acid Magenta extra, | Azo Yellow conc., |
| Orseilline R. B, | Victoria Yellow conc., |
| Acid Cerise O, | Orange No. 2, No. 4, G, |
| Acid Maroon O, | Brilliant Orange G, O, R, |
| Opal Blue, blue shade, | Black for Feathers new, conc., |
| Bleu de Lyon RR, conc., | Fast Brown O, yellow shade, |
| Cotton Blue No. 2, | Scarlet G, R, RR, 3R, 4R, 5R, |
| China Blue No. 2, | 6R, B extra, |
| Acid Green conc., | Brilliant Croceine yellow shade, |
| Naphtalene Green V. conc., | blue shade, R, B, BB, 3B, |
| Patent Blue V. A, | 5B, |
| Fast Blue O, R, 5B, | Fast Red O, |
| Black Blue O, | Claret Red G, B, R, |
| Deep Black O, | Amido Naphtol Black 4B, 4B |
| Nigrosine No. 1, 4, | extra, 6B, S. |

3. Colours which dye in an Acetic Acid bath.

| | |
|----------------------------|--------------------------------|
| Rosolane O, BO, T, | Erythrosine yellow shade, blue |
| Rosazaine O, 4G, 6G, | shade, yellow shade N, blue |
| Eosine extra AG, extra BB, | shade N, |
| Phloxine G, O, 2B, 5B, | |
| Rose Bengale G, B. | |

COLOURS SUITABLE FOR THE MANUFACTURE OF LAKES.

Lakes are compounds which are either insoluble or almost insoluble in water; they are obtained by precipitating dyestuffs on to so-called carriers (substrata) by means of certain salts, acids, soaps, etc. Also the mixtures of certain colours with substrata are termed colour lakes.

The substrata impart to the lakes the suitable condition for further application, and also bring out the bright, characteristic shades of the colouring matters, which their concentrated form frequently lacks in appearance.

Some substrata, such as Hydrate of Alumina and Green Earth, take part in the formation of the lake, and serve simultaneously as precipitating agents. There is a distinction between natural substrata — such as Heavy Spar, Green Earth, Ochre, Chalk, Gypsum, China Clay, and artificial substrata — such as Hydrate of Alumina, Blanc Fixe, Zinc White, Red Lead etc. Many artificial carriers e. g. Hydrate of Alumina and Barium Sulphate etc can be produced simultaneously with the precipitation of the colour.

In the selection of a suitable carrier, the following points have to be considered: price, purity, covering power, fineness, fixing properties, and above all, the final purpose which the colour lake has to serve. The carrier employed often exercises great influence on the beauty and fastness of the lake.

Several dyestuffs either do not combine with the substrata, or only partially so, and therefore in these cases precipitating agents must be used which precipitate the colour on to the substrata in a more or less insoluble form. The precipitating agent is selected according to the nature of the colouring matter; the principal substances employed are: Barium Chloride, Calcium Chloride, Lead Acetate, Zinc Sulphate, Tannin, Resin and Fatty Soaps.

Colour lakes are divided into the following groups:

1. Printing and Lithographic Colours,
2. Oil Colours,
3. Lime Colours,
4. Colours for Wallpaper etc.

1. Printing and Lithographic Colours.

The colour lakes, partly in the form of lumps and partly as powder, are rubbed with varnish. For lithographic purposes, the colours must be fast to water; if they bleed they are unsuitable for printing.

Good covering power is required of better printing colours, and also for certain purposes transparency, fastness to light and to lacquering.

These colours are used for printing illustrations, books, tickets, and for metal printing etc.

2. Oil Colours.

These colours, in a finely divided state, are rubbed with oil or varnish (spirit-, oil-, or copal varnish).

It is of great importance in oil colours that the colour lake is insoluble in oil. For example, if a sign board is ground with a red colour, and after drying painted over with white letters, the white would gradually turn red if the ground colour were soluble in oil. On the other hand the solubility in oil need not be considered when an article is painted with only one colour, e. g. garden utensils, machines, etc.

These colours are used for painting carriages, signals, tubs, garden utensils, placards, wooden implements etc.

3. Lime Colours.

The colour lake, in powder form, is well mixed with water and Milk of Lime, or any other binding agent. Above all things, these colours must be fast to lime, i. e. the shade of the colour must neither disappear nor change on the addition of Milk of Lime. Further, the colour must easily mix with water.

Lime colours should not "stain"; when painted on wood, the colour must not leave dye spots on the material after it has again been removed.

The lime greens produced by precipitating Basic colours (Brilliant or Malachite Green) on Green Earth, are very important colours. Yellower shades can be produced by shading with Auramine. The fastness of the greens depends entirely on the quality of the Green Earth used.

Lime colours are used for "colour-wash" of walls and ceilings, for the dyeing of artificial stones, etc.

4. Colours for Wallpapers etc.

These colours are used principally in the form of a paste or as a finely ground dry powder. The colour is mixed with a binding agent such as Glue, Caseine, Starch paste etc. and then applied by means of a machine.

For wallpapers a coarser substratum, such as Heavy Spar can be used, but for coloured papers only very finely divided substances such as Blanc Fixe, Satin White etc. come into consideration; otherwise, in "facing" the paper uneven places and spots might result.

These colours are used in the wallpaper and coloured paper industries, for ground shades and also for printing.

Pigment colours are also used in Textile printing, for dyeing sealing wax, for water colours, crayon and coloured pencils.

For the production of colour lakes the following methods are employed :

1. Colours which are precipitated with Barium Chloride.

Directions: 5 parts Sulphate of Alumina 18%, 2½ parts Calcined soda, about 2 parts dyestuff and 7½ parts (or more) Barium Chloride.

Chinoline Yellow, all brands,
Standard Yellow 5GL, 3GL,
Naphtol Yellow S, SL, SE.
Pigment Fast Yellow G, R,
" " " 3G, G, R, 2R,
Oxydianil Yellow, all brands,
Victoria Yellow conc. O, double,
Azo Yellow conc., O, R,
Dianil Orange G,
Orange 4LL, O, 2, 2L, RRL,
Brilliant Orange G, O, R,
Fast Orange O,
Pigment Scarlet G,
Paper Scarlet, all brands,
Scarlet, all brands,
Brilliant Lake Scarlet G, R, 2R,
Dianil Scarlet G, 2R.
Dianil Red 4B,
Dianil Brown, all brands,
Fast Brown yellow shade, L.
Fast Red O,
Scarlet 6R crystals,
Pigment Scarlet 3B,
Brilliant Crimson O,
Claret Red G, O, R,
Cloth Red O,
Dianil Claret Red G, B,
Fast Acid Magenta G,
Fast Acid Violet A2R, R, B,
Acid Violet N, 5BF,
Blue red shade, blue shade,

Soluble Blue, all brands,
Guernsey Blue O,
Alkaline Violet O,
Opal Blue red shade, blue shade,
green shade, extra green-
shade,
Bleu de Lyon, all brands,
Laundry Blue O,
Full Blue O,
Navy Blue V,
China Blue R, No. 1, 2,
Alkaline Blue all brands,
Deep Blue O,
Cloth Blue O,
Cotton Blue extra, OO,
Conc. Cotton Blue, all brands,
Opal Blue superior,
Cotton Light Blue O soluble in
water,
Pure Blue, all brands,
Purple Blue O,
Methyl Alkaline Blue MLB,
Methyl Blue for Cotton MLB,
Dianil Blue R, G, B,
Fast Blue, all brands,
Patent Blue all brands,
Patent Green V, O,
Acid Green all brands,
Dianil Black, all brands,
Nigrosine No. 1, 4.

2. Colours which are precipitated with Lead Salts.

Directions: 30 parts Alumina Hydrate, 20 parts Heavy Spar, about 1½ parts Dyestuff, 1 part Nitrate of Lead.

Uranine O, N,
Eosine, all brands,
Erythrosine, all brands,
Phloxine, all brands,
Rose Bengale G, B.

3. Colours which are precipitated with Tannin or Tannin-Tartar Emetic.

Directions: 30 parts Alumina Hydrate, 2 parts Dyestuff, 2 parts Tannin, 1 part Tartar Emetic.

| | |
|--|----------------------------------|
| Auramine conc., O, I, II, | Victoria Blue B, R, |
| Phosphine new, extra, | Thionine Blue GO, |
| Chrysoidine A cryst., C cryst., C extra crystals, | Safranine G, GS, conc., conc. B, |
| Vesuvine, all brands, | Rosazeine O, extra, B, B extra, |
| Cutch Brown D, G, | Magenta, all brands, |
| Dark Brown M, MB, | Acetate of Magenta, |
| Grenadine O, R, RR, | Cerise G, R, |
| Maroon O, extra, | Methylene Blue, all brands, |
| New Magenta O, P, | Malachite Green, all brands, |
| Methylene Violet, all brands, | Brilliant Green, all brands, |
| Peacock Blue P, | Coal Black O, I, II. |

4. Colours which are precipitated direct on Silicates. (Green Earth, Alumina, Ochre etc.)

Directions: 50 parts Green Earth, about 1 part Dyestuff.
All colours mentioned under 3 are suitable.

5. Colours which are precipitated upon Alumina Substratum.

a) Rosaniline Dyestuffs.

Directions: 80 parts Alumina Hydrate, 20 parts Blanc Fixe, about 2 parts Dyestuff; precipitated with Barium Chloride if necessary.

| | |
|------------------------------------|----------------------------|
| Blue red shade, blue shade, | Bleu de Lyon, all brands, |
| Soluble Blue, all brands, | China Blue R, No 1, No. 2, |
| Full Blue O, | Alkaline Blue, all brands, |
| Guernsey Blue O, | Deep Blue O, |
| Alkaline Violet O, | Pure Blue, all brands, |
| Opal Blue red shade, blue shade, | Purple Blue O, |
| green shade, extra green shade, | Methyl Alkaline Blue MLB. |

b) Alizarine Colours.

Directions: 35 parts Sulphate of Alumina 18%, 25 parts Phosphate of Soda, 9 parts Calcined Soda, about 40 parts Alizarine paste, 9 parts Turkey Red oil, 10 parts Acetate of Lime; boiled for 1½ hours with direct steam.

| | |
|------------------------------|-------------------------|
| Alizarine Orange N, | Galleine R paste, |
| Alizarine SDG, 5F, 588, 3RL, | Ceruleine A paste, |
| RX, 2A bl. bl., 1B new, | Acid Alizarine Blue BB. |
| Alizarine Brown, all brands, | |

c) Azarine.

Directions: 8¾ parts Phosphate of Soda, 5¾ parts Calcined soda, 5 parts Turkey Red oil, 2 parts Stannate of Soda, 25 parts Alum, about 1 part Azarine S.

6. Colours produced during the Precipitation.

Directions: 100 parts Beta Naphtol solution, $2\frac{1}{2}$ parts Phosphate of Soda, 100 parts Diazo or Azophor solutions.

Substrate chosen according to suitability

Beta Naphtol solution: $1\frac{1}{2}$ parts Beta Naphtol, 3 parts Soda lye 33° Tw., made up to 100 parts.

Diazo solution: 1,4 parts Paranitraniline, 12 parts Water, 0,754 parts Sodium Nitrite, cooled with Ice to 39° F. Then whilst stirring add 2,2 parts Hydrochloric acid 36° F. After allowing to settle, the solution is filtered and made up to 100 parts

Azophor solution: 5,6 parts Azophor Red PN, 50 parts water; solution after allowing to stand for $\frac{1}{2}$ —1 hour is filtered; remaining particles are dissolved in more water and the whole made up to 100 parts.

Beta Naphtol,

Beta Naphtol RL.

Beta Naphtol R,

developed with

Paranitraniline extra,
Metanitraniline,
Azophor Orange MN,
Nitrophenidine
" " " "
Azophor Red PN,
Amido Azo Benzole,
Nitrotoluidine,

Pigment Fast Red base,
Alpha Naphtylamine,
Amido Azo Toluol,
Beta Naphtylamine,
Naphtylamine Salt S,
Benzidine Base,
Tolidine Base,
Dianisidine Base.

7. Insoluble Paste Colours.

The following colours are suitable:

Pigment Chrome Yellow L,
Pigment Orange R,
Lake Red D*,
Pigment Red G,
Lake Red C extra*,
Pigment Fast Red HL,
Lake Red P*,

Brilliant Lake Red R*,
Pigment Purple A,
Pigment Red B,
Pigment Claret Red R,
Pigment Claret Red N,
Claret Red for Lake B*.

The dyestuffs marked * are precipitated according to a special process; the remainder can be ground with t... (Heavy Spar) with or without the addition of Barium Chloride.

Lake Colours, fast to Light.

Yellow:

Standard Yellow 5GL, 3GL,
Alizarine Yellow GGW, RW,
Naphtol Yellow S, SL, SE,

Pigment Fast Yellow G, R,
Flavazine T,
Pigment Chrome Yellow L*.

Orange:

| | |
|-----------------------------------|-------------------------------|
| Alizarine Orange N ⁺ , | Nitrotoluidine developed with |
| Fast Orange O, | -Naphtol, |
| Pigment Orange R, | Pigment Scarlet G. |

Red:

| | |
|------------------------------------|-----------------------------------|
| Pigment Red G, B, | Pigment Fast Red Base developed |
| | with B-Naphtol ⁺ , |
| Paranitraniline ext. } developed | Lake Red C, D, P ⁺ , |
| Azophor Red PN, } with | Alizarine* SDG, 5F, 588, 3RL, |
| | RX, 2A bl bl, IB, new, |
| | Pigment Scarlet 3B ⁺ . |
| Pigment Fast Red HL ⁺ , | |

Claret Red and Violet:

| | |
|---------------------------------------|------------------------------|
| Claret Red for Lake B, | Methyl Violet 2R on Green |
| Galleine R paste, | Earth, |
| Acid Alizarine Blue BB ⁺ , | Methylene Violet BN on Green |
| | Earth. |

Blue:

| | |
|-------------------------------------|---------------------------|
| Methylene Blue R, BB ⁺ , | Thionine Blue GO on White |
| Blue S. | Earth ⁺ . |

Green:

Malachite Green, all brands, on Green Earth⁺, } also in combination
 Brilliant Green, all brands, on Green Earth⁺, } with Auramine
 Ceruleine paste A.

The brands marked ⁺ are distinguished for their excellent fastness to light.

COLOURS SUITABLE FOR GLUE AND GELATINE.

All easily soluble colours are suitable for dyeing gelatine and glue. If the glue reacts very alkaline, the following colours, which withstand alkalis, are to be used:

| | |
|-------------------------------|---------------------------------|
| Chinoline Yellow O, extra, | Brilliant Croceine, all brands, |
| Naphtol Yellow S, | Coccinine O, B, |
| Dianil Yellow 3G, G, R, 2R, | Dianil Brown, all brands, |
| Victoria Yellow conc., O, | Scarlet 6R crystals, |
| Azo Yellow conc., O, | Fast Brown O. |
| Dianil Orange G, | Rosazeine O, B, extra, B extra, |
| Orange No. 4, No. 2, | Claret Red G, R, B, |
| Brilliant Orange G, O, R, | Dianil Claret Red G, B, |
| Victoria Scarlet, all brands, | Acid Violet N, 5BF, |
| Scarlet all brands, | Patent Blue V, L, A, M, B, N. |

COLOURS FOR SOAP DYEING.

Soap is dyed according to two methods:

- hot. The colour solutions are added direct to the liquid soap in the boiling kettle.
- cold. The colour solutions are added to the thin, dry soap-shavings. This mixture is worked in the mixing machine, until the whole is dyed uniformly.

For method "a" dyestuffs are used which withstand boiling in alkaline soap solutions. In most cases, however, the colouring effects which disappear in boiling become again apparent on cooling.

| | |
|-----------------------------------|-------------------------------|
| Chinoline Yellow O, | Transparent Brown O, |
| Uranine O, | Soap Brown I, II, G, |
| Victoria Yellow conc., double, O, | Soap Pink A, |
| Azo Yellow conc., O, R, | Safranine AN extra, conc., B, |
| Chrysoine R, | Rosazeine O, B, B extra, |
| Vesuvine 4BG conc., | Transparent Violet O, |
| Orange No 4, No. 2, 2L, No. 64, | Fast Acid Violet, all brands, |
| Brilliant Orange G, O, R, | Ethyl Blue BF, |
| Scarlet, all brands, | Fast Acid Blue B, |
| Brilliant Croceine R, B, 2B, PL, | Acid Violet 5BF, |
| 3B, 5B, | Patent Blue L, V, A, |
| Scarlet 6R crystals, | Naphtol Green B, |
| Fast Brown L, | Transparent Green O, |
| Fast Red O, | Soap Green B, G |

COLOURS FOR SPIRIT SOLUBLE LAKES.

| | |
|------------------------------------|--------------------------------------|
| Auramine conc., | New Magenta O, P, |
| Spirit Yellow RP, AR, | Spirit Violet VR, |
| Victoria Yellow conc., | Methyl Violet 2B chem. pure, |
| Spirit Orange RRP, | 6B chem. pure, |
| Carbazone A cryst, C cryst., | Blue No. 1 spirit., greenish spirit, |
| C extra cryst., | Opal Blue superior spirit, |
| Phosphine extra, new, | Fast Blue O spirit, |
| Cutch Brown D, G, | Spirit Blue BL, VBD, DR, |
| Dark Brown M, MB, | Methylene Blue DBB extra conc., |
| Vesuvine extra yellow, 4BG conc., | Methylene Green extra yellow |
| 2R, 2B, | conc., |
| Spirit Brown PS, BV, | Malachite Green crystals extra, |
| Orange 2L, | Brilliant Green crystals extra, |
| Eosine extra spirit, No. 1 spirit, | Spirit Red B, |
| Spirit Scarlet G, | Spirit Pink E5B, EEG, |
| Cyanosine O spirit, | Safranine AN extra, |
| Rosazaine 4G extra, G extra, | Spirit Black, |
| extra, B extra, | Nigrosine D spirit, |
| Magenta, all brands, | Coal Black O, I, II. |
| Cerise G, R, | |

COLOURS FOR INK MAKING.

a) Aniline Inks, Hectographic Inks.

| | |
|---------------------------------|---------------------------------|
| Eosine extra AG, extra 2A, | New Magenta O, |
| extra yellow S, extra S, | Methyl Violet. all brands, |
| extra conc., | Malachite Green cryst. extra, |
| Rosazaine O, extra, B, B extra, | Brilliant Green crystals extra, |
| Magenta extra yellow, extra | Coal Black O, I, II, 6618 G. |
| yellow small cryst, small | |
| crystals double refined, | |

b) Colours for shading Gall-nut Inks.

| | |
|------------------------------|----------------------------|
| Patent Blue L, V, A, AGL, | Naphtalene Green V, conc., |
| Ink Blue 3G, 2G, G, | Wool Printing Black NB, |
| Acid Green conc. M, conc. O, | Carbon Black GA, |
| M, conc. NL, conc. S, | Nigrosine No. 1, 4. |

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I. THE BLEACHING OF COTTON, MERCERISING AND FINISHING.

A. THE BLEACHING OF COTTON.

1. Loose Cotton.

The cotton is carefully boiled with Soda or Soda lye in open wooden vats, or under slight pressure in lead-lined iron vessels with removable lids for greater convenience of entering and withdrawing the material. The further treatments, such as rinsing, souring and chemicking etc. are carried out in the same vessel which, for this purpose, is fitted with a pump.

2. Roving.

Cotton roving is conveniently bleached in mechanical apparatus after the packing system. The cotton remains in the apparatus until all bleaching operations are completed. For this reason these installations must be constructed of such materials as will resist the action of alkalis, acids, and hypochlorous acid salts, for which purpose hard lead, and nickel lined gun metal apparatus are most suitable.

On the average 2-3% Calcined soda (of the weight of the cotton) is used for boiling, and about 1/4% Soap or Turkey Red oil is added. After boiling the material is rinsed in the lead-lined vessel and chemicked with Sodium Hypochlorite of 1/2-1° Tw. After a second washing it is soured with Sulphuric acid of 1° Tw., to which has been added some Methylene Blue, for blueing the material. It is then thoroughly washed, hydroextracted, and finally dried.

Operating with Sodium Hypochlorite instead of Chloride of Lime though rather more expensive, has many advantages, chief of which are its greater solubility and more energetic bleaching power.

3. Cotton Yarn.

The general mode of yarn bleaching consists of boiling with water; this can be done in open cisterns, but more economically in kiers under a pressure of about 2-2 1/2 atmospheres. Thorough washing is followed by slight souring or, if the yarn is intended for light shades, by chemicking and souring. Another washing completes the bleaching operation. As the cotton does not easily wet out in water, additions of Soda, Soda lye and Soaps hasten

the thorough boiling. They also react more strongly upon the foreign substances in the cotton; consequently these alkaline baths effect the boiling more easily than water alone. Therefore, a common method of boiling is to use 2—3% Caustic soda (of the weight of the yarns) with an addition of small quantities of Turkey Red oil.

Generally, the cotton yarns to be boiled are put together loose or tied up in knots, in single pounds, or put into sacks. They are boiled in the kier for 3—4 hours with clean water, under pressure of 1.5—2 atmospheres; then the steam is turned off and the yellowish coloured water drained away whilst clear cold water is continually run in above. By this means the boiled off liquid is quickly removed from the yarn, and kier stains avoided. After rinsing, the yarns are entered into a clear solution of Chloride of Lime $\frac{1}{2}$ —1 $\frac{1}{2}$ % Tw., then rinsed again, soured with Sulphuric acid, and well washed on the washing machine. Finally they are carefully dried.

Where a pure full bleach is not required, there has been introduced in some cases cold bleaching, by packing the yarns, cops etc. into a specially constructed iron receptacle, filling up the intermediate spaces with loose material, and circulating for 4 hours under pressure of 1 $\frac{1}{2}$ —2 atmospheres with a solution of Chloride of Lime 1 $\frac{1}{2}$ % Tw. The yarn is then washed under pressure for 20 minutes, and finally soured with Hydrochloric acid of 1% Tw. in the same manner. After rinsing once more the bleaching is finished. In this manner the onerous and tedious boiling is avoided and consequently the loss of weight considerably reduced.

Another method of bleaching yarn on cops and cheeses has been introduced by F. Erban and L. Pick. By this method the cops etc. are treated on special apparatus for several hours with mixtures of Sodium Hypochlorite and Turkey Red oil, or better still, with Stockhausen's Monopole soap, which does not form insoluble combinations with Lime, and is therefore preferable with hard waters. Thus, after being well rinsed, if necessary with an addition of some Hyposulphite of Soda, the yarn is bleached perfectly white.

4. Cotton Fabrics.

Previous to bleaching the goods are either singed or cropped, according to their subsequent mode of treatment. The object of singeing is to remove the loose hairs, so-called fluff, from the surface of the cloth, whereas the cropping machines are used for cutting away the more prominent unevennesses, knots etc.

On the gas singeing machine the cloth passes one or more rows of gas jets by which the fluff is singed off.

For heavy goods the plate or roller singeing machine, for light materials the gas singeing machine is preferred.

After singeing and previous to bleaching the goods are gathered into rope form by running through small porcelain rings.

Bleaching proper begins with alkali boiling, after the extraneous substances added in weaving have been almost entirely removed from the cloth, i. e. after the goods have been steeped. Steeping can

be effected by mechanical or by chemical means, and consists in working on washing machines, or in bringing about a slight fermentation by impregnating the cloth with alkaline or acid liquors. Starchy matter is thus rendered soluble and removed for the most part in subsequent washing. The more thoroughly this is done, the easier will be the bleaching process.

The material can be steeped—

1. In cold Sulphuric acid of about 3° Tw., it is allowed to lie in this solution for 6–12 hours.

2. In a solution of about $\frac{1}{4}$ % (of the weight of the material) dry Caustic soda at boiling point; it is impregnated and then allowed to lie tightly packed in covered wooden boxes for 24 hours. This method is especially suitable for thick cotton cloths.

3. In clear lye, previously used, at about 140° F., until a sour smell indicates the commencement of fermentation.

The two latter methods act more strongly upon the husks and seed capsules present in the cotton than the treatment with acid which, on the other hand, when used cold, is easier to manipulate. The soured goods must be interlined with wet packing sheets, in order to prevent their getting dry in places.

Alkali Boiling.

The boiling process (boiling in alkali) is the most important operation in bleaching and the final results greatly depend on it.

The material is packed in rope form into the kier by experienced workmen, and must fill the interior evenly; it is then covered over with clean canvas, and weighted with well galvanized iron rails. The lye is prepared in a separate vessel and is run into the kier together with water, whilst the pump is in action. The level of the liquid must be about 10–15 inches above the material. It is advisable to filter the whole liquid through a cotton cloth when entering the kier.

The lye which is already warm when entering the kier, is gradually heated to the boil; some Bisulphite is then added, the kier lid fastened down and the boiling continued under a pressure of about $2\frac{1}{2}$ atm.

The higher the pressure, the sooner the process of alkali-boiling is terminated; on the other hand the pressure ought never to exceed $2\frac{1}{2}$ atm., otherwise tendering of the cotton fibre takes place. On an average a good circulation of the boiling liquid through the kier for 6 hours will be sufficient if the goods are previously well scoured.

The goods must be thoroughly washed after kier boiling in order to remove all the foreign substances rendered soluble by the boiling in alkali.

After washing, the cloth is either chemicked and soured, or first soured, then chemicked and again soured, each operation being followed by washing.

A final thorough washing is indispensable, for all the mineral acid must be removed, as in drying, this would concentrate and injure the fibre; it might also affect the shade when dyed.

E Lauber gives the following directions, taken from practice for bleaching cloths intended for dyeing and printing:

I. Heavy Cloths.

1. Singeing.
2. Passage through a Sulphuric acid bath 3° Tw. (allowed to lie 4—5 hours, preferably over-night). Care must be taken not to let it dry.
3. Washing.
4. Boiling: 8—10 hours under 1½ atm. pressure.

For 1000 lbs. material are required:

| | |
|--------|--------------------|
| 25 lbs | dry Caustic soda |
| 10 „ | Solvay soda |
| 4 „ | Olive oil soap |
| 2.5 „ | Bisulphite 72° Tw. |

5. Washing.
6. Chemicking with clear Chloride of Lime solution 1/3—1" Tw.
7. Washing.
8. Souring with Sulphuric acid 1½—3° Tw.
9. Final washing

•

II. Light Cloths.

The bleaching process for light cloths is the same as for heavy cloths, except that less alkali is used in boiling.

For 1000 lbs. of material are required:

| | |
|---------|--------------------|
| 22 lbs. | dry Caustic soda |
| 7 „ | Solvay soda |
| 3½ „ | Olive oil soap |
| 1½ „ | Bisulphite 72° Tw. |

III. Heavy Flannelettes.

1. Impregnating with boiling Soda lye (16 lbs. 76° Tw. per 1000 lbs. material). The goods are tightly packed in wooden boxes and kept there well covered for 24 hours.
2. Washing
3. Boiling: 8—9 hours at 1½ atm. pressure.

1000 lbs. material require:

| | |
|---------|--------------------|
| 97 lbs. | Soda lye 76° Tw., |
| 8 „ | Solvay soda, |
| 4 „ | Olive oil soap, |
| 2 „ | Bisulphite 72° Tw. |

The further operations are as described under I.

As special cases applicable to bleaching the following may be mentioned:

1. In bleaching multi-coloured fabrics, cloths with multi-coloured borders etc. special care has to be taken. Before all, the goods must be boiled without pressure, i. e. in an open vessel. Calcined soda must be used instead of Caustic soda (not more than $1\frac{1}{4}^{\circ}$ of the weight of the material). The boiling and subsequent rinsing in the vessel is repeated 2-3 times: the goods are then washed, treated with Chloride of Lime $\frac{3}{4}$ - $1\frac{1}{2}^{\circ}$ Tw. for $1\frac{1}{2}$ -2 hours, washed again, passed through a weak anti-chlor bath, and finally soured with Muriatic acid of about 1° Tw. After a short rest the goods are finally washed.

2. For cotton goods intended to be dyed with turkey red, chemicking, if possible, should be dispensed with, as it affects the fulness and beauty of the colours. Only when absolutely necessary, as e. g. in dyeing pink shades, weak chlorine baths are used.

3. White materials require a very thorough bleach, they must not turn yellow in storing. It is advisable to boil them twice, first with Lime and then with Soda. After chemicking and washing, they are blued with Ultramarine.

B. MERCERISING.

Merцерising produces a silky lustre on the cotton fibre, increases its strength, and enhances its affinity for both mordants and dyestuffs.

All sorts of cotton can be mercerised, the best effect, however, is obtained on Egyptian cotton, which has the longest staple.

The process is dependent on the concentration of the Caustic soda used, and the temperature at which it is carried out. The length of the process exercises very little influence on the final result.

For mercerising, Soda lye of 55—65° Tw. is generally employed. A caustic soda solution of 15° Tw. does not mercerise; a slight effect, however, can be seen when Soda lye of 25° Tw. is used. The mercerising effect increases with the strength of the alkaline liquid, the maximum being obtained with lye of 65° Tw.

The temperature of the lye has also a great bearing upon the mercerising, as a rule, the lower the temperature, the better are the results. With dilute liquids the influence of the temperature is more marked than with concentrated lyes.

The property of the lye to impart to the goods a greater strength is utilised in dyeing thin materials, which are treated and manipulated with difficulty, by mercerising them with a lye of 23—42° Tw.; at the same time the fibre attains greater affinity for the dyestuffs.

Two methods can be adopted in mercerising both pieces and yarns: either the cotton is subjected unstretched to the action of the concentrated lye which is kept cold, and is afterwards stretched; or it is stretched and mercerised simultaneously.

When mercerising piece goods, these pass through concentrated and well-cooled soda lye in a padding machine, where they are squeezed by heavy cast-iron rollers; they are then rolled up, allowed to lie for some time, and stretched on the frame, or sometimes are run on to the stentering machine directly after passing the rollers of the padding machine.

Whilst being stentered the material is rinsed with hot water and then soured and washed in a cistern. The wash water is repeatedly used until it reaches 6—8° Tw. It is then used for other purposes e.g. for bleaching, where it is used to de-size the goods, or as the kier boiling liquor. Recently, special mechanical appliances have been introduced in order to recover the Caustic soda lye in a concentrated form.

Raw material is very seldom mercerised, as the sizing prevents it from being evenly impregnated with the lye; therefore steeped and boiled-off goods are generally used and the bleaching operation is carried out after mercerising.

C. FINISHING RECIPES FOR COTTON.

A. Linings.

1. Black Double Cloth.

100 galls 500 Litres of Finish
(for 1200 metres).

| | |
|-----------------------------------|-----------------------------------|
| 5 lbs, 2,5. kg Fat, | 12 gall. 60 lit Logwood Decoction |
| 2 „ 1 „ Palm Fat, | 20 lbs. 10 kg Wheat Starch |
| $\frac{3}{4}$ „ 0,2 „ Calc. Soda, | 40 „ 20 „ Potato Starch |
| $\frac{1}{25}$ „ 0,02 „ Bichrome, | |

boil 15 minutes in a closed finishing tub.

Finished once on both sides, dried, the finish slightly diluted, again finished on both sides, dried, sprinkled, allowed to lie for a day, and mangled

2. Black Shirting.

Mangled Cloth.

100 galls. 500 Litres of Finish
(for 1200 metres).

| | |
|-------------------------------|--|
| 35 lbs. 17,5 kg Potato Flour, | $\frac{1}{2}$ lbs. 0,25 kg Calc. Soda, |
| 25 „ 12,5 „ Wheat Starch, | 16 gall. 80 Lit Logwood |
| 5 „ 2,5 „ Fat, | Decoction, |
| 2 „ 1 „ Palm Fat, | $\frac{1}{25}$ lb 0,02 kg Bichrome |

boil for 30 minutes.

Finished on both sides, dried on drying cylinders, starched again with the starch, dried, finished with the decoction, dried again, sprinkled, allowed to lie on the hydraulic mangle.

3. Black Shirting.

Calendered Cloth.

100 galls 500 Litres of Finish
(for 2400 metres).

| | |
|------------------------------------|--------------------------------------|
| 80 lbs. 40 kg Potato Flour | $\frac{3}{25}$ lbs. 0,04 kg Bichrome |
| 16 galls 80 lit. Logwood Decoction | |

heated to the boil in an open vessel.

Finished once on both sides, dried on drying cylinders, sprinkled, allowed to lie for a day, and passed the same side three times warm through the friction calender.

Note: Light coloured calendered shirtings are finished in the same manner, but with an uncoloured finish.

4. Black Glacé.

100 galls 500 Litres of Finish
(for 1800 metres).

| | | | |
|---------|---------|-------------------|---|
| 3 lbs. | 1,5 kg | Beeswax | } boiled till the wax is dissolved. |
| 1 oz | 0,03 kg | Bichrome | |
| 6 galls | 30 lit. | Logwood Decoction | |

Then are added:

62 galls 310 lit. Water 6 galls 30 lit. Logwood Decoction.

Then further added:

40 lbs. 20 kg Wheat Starch in 20 lbs. 10 kg Potato Starch in
10 galls 50 lit. Water and 10 galls 50 lit. Water

boiled moderately fast for 15 minutes in a closed finishing tub.

Finished once on both sides, dried, sprinkled, then the seams overlaid so that they adhere to one another, sprinkled again and the goods allowed to lie for a day. Calendered on the friction calender — about 250 metres on each roller, — then passed hot three times with wax through both cylinders with friction, and three times without wax with friction between steel and paper rollers.

Logwood Decoction.

100 lbs 50 kg Rasped Fermented Logwood are boiled with
60 galls. 300 litres Water during 2 hours.

5. Finish for Lawn.

100 galls 500 Litres of Finish
(for 3000 metres).

25 lbs. 12,5 kg Potato Starch 10 lbs 5 kg Glycerine.
12 „ 6 „ Turkey Red Oil 50%

6. Finish for Embossed Goods.

100 galls 500 Litres of Finish
(for 1800 metres).

25 lbs. 12,5 kg Wheat Flour, 4 lbs. 2 kg Japanese Wax,
25 „ 12,5 „ Potato Flour, 2 „ 1 „ Softening

boiled for 10 minutes.

Sprinkled after finishing and cooling, allowed to lie for a day, then calendered on the friction calender, and finally embossed hot.

7. Finish for Croisé.

100 galls 500 Litres of Finish
(for 2400 metres).

| | | | | |
|-----------------|---------------|-----------------------|--------|------------|
| 25 lbs. 12,5 kg | Wheat Starch, | 1 lb. | 0,5 kg | Soft Soap, |
| 8 „ 4 „ | Potato Flour, | 1 lb | 0,5 „ | Cocoa Fat, |
| 40 „ 20 „ | China Clay, | 3 $\frac{1}{5}$ pints | 2 lit. | Glycerine |

slowly boiled for 15 minutes in a closed vessel.

China Clay is tinted as required

Note: For heavy Croisés less China Clay and more glycerine is used; e. g. 10 kgs China Clay and 3 litres glycerine. The goods are once finished on both sides, dried on drying cylinders, and allowed to lie for a day after being sprinkled. They are then finished with slight pressure on the friction calender with heated steel roller.

8. Pocketing Twill.

100 galls 500 litres of Finish
(for 1800 metres).

| | | | | |
|----------------------------|---------------|-----------------|--------|-----------------|
| 24 lbs. 12 kg | Wheat Starch, | 1 lbs. | 0,5 kg | Marseilles Soap |
| $\frac{1}{4}$ pints 3 lit. | Glycerine, | $\frac{2}{5}$ „ | 0,2 kg | Olive Oil |

boiled for 10 minutes.

The Finish is tinted as required. The goods are finished once on both sides, dried on drying cylinders, sprinkled and mangled.

9. Finish for Heavy Cotton Cloths.

100 galls 500 litres of Finish
(for 3000 metres).

| | | | | |
|---------------|---------------|-------|------|-----------------|
| 60 lbs. 30 kg | Dextrine, | 6 lbs | 3 kg | Turkey Red Oil, |
| 30 „ 15 „ | Potato Flour, | 4 „ | 2 „ | Marseilles Soap |
| 50 „ 25 „ | Epsom Salts, | | | |

boiled for 10 minutes.

Finished once on both sides, dried on drying cylinders, sprinkled twice, and, rolled up tightly, allowed to lie for 24 hours.

B. Articles for Bookbinding.

These articles serve as imitations of leather in the bookbinding trade. They are manufactured either from linen or cotton fabrics. The linen cloths for bookbinders are chiefly made in black or dark green colours, and used almost exclusively for account books. The fabrics must be finished as close as possible, in order to prevent the glue from striking through.

Finish for Dark Green.

500 Litres

(for about 800 metres).

| | | | |
|-----------------|---------------------------|------------------|------------------------|
| 15 lbs. 7,5 kg | Glue (previously soaked), | 4 galls 20 lit. | Logwood Decoction |
| 5 ,, 2,5 ,, | Tallow, | 3 1/2 pints 2 ,, | Quercitron 7 1/2° Tw., |
| 2 ,, 1 ,, | Palm Fat, | 4/5 ,, 0,5 ,, | Nitrate of Iron |
| 3/10 ,, 0,15 ,, | Bulliant Green | | 91° Tw., |
| | crystals extra | 60 lbs. 30 kg | Potato Flour |

boiled for 15 minutes.

Finished three times on both sides and dried each time on drying cylinders; then sprinkled, allowed to lie for a night and mangled 4—5 times. The finishing preparation is coloured with Logwood and Bichrome.

C. Raised Cotton Goods.

Melton, Repp, Flannel, Fustian.

In order to impart the fine clothlike handle and gloss to Meltons, they are crabbed and steamed before dyeing. When dyed, the goods are passed through a solution of vegetable glue on a padding machine, then dried on the felt calender and finally stentered.

Flannels and Fustians are finished with wheat starch or dextrine, usually with an addition of softening agents, such as softening, glycerine, etc., then dried on the calender and finished on the decatizing cylinder.

D. Moleskin, Imitation Leather.

These heavy cotton cloths are finished on one side after dyeing: for this purpose a double cylinder finishing machine is used, whose lower oaken cylinder of about 20 inches diameter dips in the finish. The upper wooden cylinder of about 12 inches diameter is covered with cotton cloth. The goods pass between the two cylinders, and are thereby finished on one side. The success of the operation depends on an accurate distribution of pressure, which must be regulated according to the various strengths of the fabrics. The finish differs for shorn and unshorn goods (Imitation Leather).

1. Finish for Unshorn Goods.

| | | | |
|---------------|-----------|-------------------|-------|
| 30 lbs. 15 kg | Dextrine, | 9 galls 45 litres | Water |
|---------------|-----------|-------------------|-------|

boiled for 15 minutes in an open vessel.

The finish must be clear and when hot must be 6° Tw. It must be kept hot during the finishing process. The goods are first finished on the back, then plaited down, then finished on the right side, again plaited down, and lastly dried on the cylinder drying machine.

2. Finish for Shorn Goods.

100 lbs. 50 kg. Liquid Animal 25 lbs. 12,5 kg Softening,
Glue 64° Tw. 16 galls 80 lit. Water

boiled for 15 minutes in an open vessel.

The finishing preparation is reduced to 6—9° Tw., according to the nature of the fabric. The goods are first finished on the back, plaited down, then finished on the right side, again plaited down, and finally dried on the cylinder.

E. Light Tailoring Cloths, Umbrella Cloths, Italians.

These articles are generally crabbed and steamed before dyeing, in order to give the finished cloth a close surface. They are dyed on the jigger, or on the padding machine, and when dried (which operation is usually carried out on the stentering machines), are finished only slightly or not at all. Plain cloths which are to receive a silk finish, must not be finished with any preparation containing fat, as fatty substances will easily clog the rollers of the calender rollers.

F. Heavy Tailoring Cloths.

When dyed and dried, the goods are passed, in a finishing or padding machine, through a diluted solution of Turkey Red Oil and Marseilles Soap, in such a manner that the cloth takes up about

2% Turkey Red Oil,

0,25% Marseilles Soap

of its own weight. An addition of 2—3% Crystallised Glauber's Salt will give the cloth a fuller handle. It is then best dried in the hotflue or by hanging, and calendered under moderate pressure after cooling, by passing it through steel-, paper- and steel rollers, and plaiting it down instead of rolling it up. The gloss thus produced is removed by passing over a steaming table. From there the goods are rolled up and left in that state for several hours.

G. Corduroy and Velvet.

Corduroy and Velvet are finished on the back, by passing them by means of guide rollers over a wooden cylinder which dips into the finishing trough. The superfluous finish is removed from the fabrics by doctors. Directly after finishing, the goods are dried, Corduroy on the stenter, Velvet on the stentering frame.

Finish for Corduroy.

200 lbs. 100 kg Glue Gelatine 10 lbs. 5 kg Bone Fat,
50%, 4/5 pints 0,5 lit. Turpentine
240 „ 120 „ Softening,
18 gall 90 lit. Water,

boiled for an hour in an open vessel.

This mixture is diluted to 2—5° Tw., according to the desired finished effect.

Finish for Velvet

| | | | | |
|------------|---------|-----------------------------------|-------------------------------|----------------|
| 40 lbs. 20 | kg Glue | Gelatine | 6 lbs. 3 kg | Glauber's Salt |
| 5 | 2.5 | 50 ⁹ / ₁₆ , | | cryst., |
| 1/2 | 0,25 | Wheat Starch, | 40—80 gall. 2—400 lit. water, | |
| | | Olive Oil, | 1/6 pints 0,1 litre | Turpentine |

boiled for 15 minutes in an open vessel.

Black, dark blue and dark green velvets, more rarely corduroys, are frequently brushed over with a fine oil colour before finishing, which embellishes and deepens the shades. Two-colour effects can also be produced in the same manner. These oil colours are laid on either by means of finely engraved rollers or specially constructed brushing machines, and immediately spread over most finely by brushing lengthways and across.

Cotton velvets are also brightened after being finished. This is done by washing, smoothing, brushing and shearing, all of which operations are performed on special machines.

H. Multi-coloured Fabrics.

Sizing additions for yarns, for multi-coloured blouse and dress materials.

1. Size for Yarn in the Cistern.

30 galls 150 litres
(for 300 lbs. of yarn).

| | | | |
|--------------|---------------|------------------|---------------------|
| 10 lbs. 5 kg | Potato Flour, | 3 lbs. 1,5 kg | Japanese Wax, |
| 10 | 5 | Maize Starch, | 30 galls 150 litres |
| 2 | 1 | Chloride of Mag- | |
| | | nesia, | |

boiled for 15 minutes in an open vessel. In sizing the liquid is diluted with water to half its strength.

2. Size for Sizing Machine.

240 galls 1200 litres
(for about 5000 lbs. of yarn).

| | | |
|-----------------|---------------|--|
| 300 lbs. 150 kg | Potato Flour, | } boiled for 15 minutes in an open vessel. In sizing the liquid is diluted with water to half its strength. |
| 200 | 100 | |
| 150 | 75 | |
| 100 | 50 | |
| 50 | 25 | |
| | | |
| | | |
| | | |
| | | |
| | | |

The finishing of multi-coloured fabrics is mostly limited to slight calendering or mangling, inasmuch as the sizing usually suffices to give the necessary handle.

For a soft woolly handle a weak soap bath at about 104° F. is given. The yarn is squeezed out and dried without being previously rinsed. A cheap finish for common qualities of bedding and other multi-coloured fabrics can be produced with Epsom salts and dextrine. This Epsom salt finish is chiefly made use of in order to give the goods a thick, full handle and increased weight.

According to the class of goods this finish is used in strengths of 8—33° Tw.

Standard Finish:

in 30 galls 150 litres Water.

| | | |
|---------------|---------------|-----------------|
| 50 lbs. 25 kg | Dextrine | } about 33° Tw. |
| 60 „ 30 „ | Epsom Salts | |
| 4 „ 2 „ | Monopole Soap | |

The goods are passed on a padding machine through the correspondingly diluted finish, then dried on the stentering frame, and sprinkled as required.

I. Tent Canvas, Baggings etc.

Waterproof Finishes.

For the production of porous waterproof finishes melted or dissolved organic products are used, such as wax, paraffin, ceresine etc. These substances are dissolved in very volatile solvents, such as benzine, petroleum ether, and others, or in slightly volatile solvents, such as aniline, nitrobenzole, o-Toluidine, Chloraniline and similar substances. The former method is rather dangerous, on account of the inflammability of the solvents employed; their application, however, is very simple, as it is quite sufficient, in order to finish the goods by removing the solvent, to dry them for a short time on the cylinder or stentering frame.

The operation with the slightly volatile solvents is safer. The impregnating liquid is applied to the cloth in the form of a fine spray by means of a spraying apparatus, or with rotating rollers, and the solvent is removed by steaming.

For the production of non-porous finishes which close up the pores of the fabric the ammoniacal copper oxide solutions to dissolve celluloid can be utilized. Ammoniacal copper oxide solutions are obtained by the reaction of ammonia upon copper turnings in presence of air. It can also be obtained by precipitating a solution of copper sulphate and caustic soda, and dissolving the precipitate in ammonia. The precipitation must take place at a temperature below 68° F., and the precipitate must be thoroughly washed and pressed out. For dissolving the precipitate, ammonia of the specific weight of 0.93 is used.

The goods are passed on the padding machine, according to quality, through solutions of 7—12° Tw., and dried immediately afterwards in a well ventilated hot air drying machine. Undyed fabrics acquire thereby a bluish-green shade of great brilliancy, which, in practice, is called metallic green. By passing the goods through dilute acid, which dissolves the precipitated copper but retains the brilliancy, other coloured effects can be obtained.

The most usual method for the production of waterproof goods, especially applied to tent canvas, consists in filling the fabrics with oleate metal soaps, particularly with alumina oleate. The goods are impregnated with acetate of alumina on the padding machine, then slowly dried, and hung at a temperature not exceeding 104° F. The goods are then passed through a hot, soap solution, in which fats, wax, resins etc. have been dissolved, then dried, again hung, and finally mangled or calendered.

Recipe for medium canvas goods:

1. Mordanting.

The goods are passed three times at 113° F (indirect heating) through acetate of alumina of 11° Tw., on the padding machine, and dried by hanging at about 104° F. for at least 12 hours.

2 Soaping.

In 60 galls (300 litres) of solution:

| | |
|---------------|----------------------|
| 40 lbs. 20 kg | Resinous Soap, |
| 30 „ 15 „ | Stearine, |
| 8 „ 4 „ | Paraffin, |
| 4 „ 2 „ | Japanese Wax, |
| 10 „ 5 „ | Linseed Oil Varnish. |

The goods are passed twice through the solution on a padding machine at 140° F. and dried by hanging.

According to requirements the goods are afterwards glued, by passing them through a solution of 10 kg carpenter's glue in 300 litres water, and finally mangled.

II. DETECTION OF THE TEXTILE FIBRES AND

A. TEXTILE

1. Reaction of the most

| Reagent | Animal Fibres | | Vegetable | | |
|--|---|----------------|------------------------------|-------|-----------|
| | Wool | Silk | Cotton | Linen | Hemp |
| Burning Test | Burn slowly, giving off the characteristic smell of alkaline fibres | | Burn quickly emitting little | | |
| Caustic Soda | soluble | | insoluble, the cellulose | | |
| | cold | hot | | | yellow |
| Alkaline Lead solution ¹⁾ | black | | | | |
| Sulphuric Acid 168° Tw. | insoluble | soluble | easily soluble | | slowly |
| Fuming Nitric Acid | yellow insoluble | yellow soluble | insoluble, the cellulose | | |
| | | | | | yellow |
| Ammoniacal Copper sol. ²⁾ | cold insoluble | soluble | soluble | | uncertain |
| Ammoniacal Nickel sol. ³⁾ | | soluble brown | | | |
| Aniline Sulphate | | | | | yellow |
| Chlorine and Sulphite or Ammonia ⁴⁾ | | | | | |
| Iodine and Sulphuric Acid ⁴⁾ | | | blue | | yellow |
| Diphenylamine and Sulphuric Acid | | | | | |

¹⁾ Alkaline lead solution added to an alkaline wool solution gives, on neutralising, a black precipitate of lead sulphide.

²⁾ Freshly prepared by dissolving precipitated and well washed copper hydroxide in a little concentrated ammonia.

³⁾ Freshly prepared by dissolving precipitated and well washed nickel hydroxide in a little concentrated ammonia.

⁴⁾ Chlorine gas is allowed to act on the moist fibre which is then slightly rinsed and treated with a solution of neutral sodium

OF DYESTUFFS FIXED ON THE FIBRE.

FIBRES.

important Textile Fibres.

| Fibres | | Artificial Fibres | | | Remarks |
|------------------------|-------|-------------------|-----------------|-----------|---|
| Jute | Ramie | Chardonnnet | Pauly | Viscose | |
| odour and acid vapours | | | | | |
| fibres turn yellow | | | | | Besides the animal fibres certain cellulose fibres are also soluble in caustic soda |
| brown | | | | | |
| | | | | | Reaction for Wool (Sulphur) |
| soluble | | easily soluble | | | |
| fibres turn yellow | | yellow, soluble | | | |
| brown | | | | | |
| insoluble | | insoluble | soluble | | |
| | | insoluble | green insoluble | insoluble | |
| yellow | | | | | Reaction for Ligno cellulose |
| red brown | | | | | Reaction for Jute and for New Zealand hemp |
| yellow | blue | | | | Reaction for microscopic determination of vegetable fibres |
| | | blue | | | Reaction for Nitric acid |

sulphite or ammonia. In the first case a magenta shade is produced, and in the second case, a brown.

⁵⁾ A solution of iodine of certain concentration is allowed to act for 1—2 minutes on the microscopic preparation, the excess removed with filter paper, and sulphuric acid of definite concentration added. For the peculiarities of the reaction see v. Höhnel, „Mikroskopie der technisch verwendeten Faserstoffe“.

2.

In order to distinguish mercerised from unmercerised fabrics, either a microscopical test or a comparative dye trial with Methylene Blue etc. is made. The latter dyes the mercerised fibre considerably darker than the non-mercerised fibre. Another determination is that recommended by J. Hubner:

The cotton is treated for a short time in a solution of 20 grammes of Iodine in 100 cc. of a saturated aqueous solution of Potassium Iodide. On washing off, the unmercerised cotton turns white and the mercerised cotton remains dark blue.

A further method dependent upon the principle that cotton which has been mercerised for a second time does not receive any increased affinity for dyestuffs, is that of H. David.

The textile material is first kier boiled, or in case it has been dyed, it is de-colourised as much as possible, and after squeezing off, stretched on a frame. A piece of the woven material is then moistened with Caustic Soda 76° Tw. A second piece is then moistened with about the same volume of dilute Caustic Soda, and finally a third piece is moistened with about 3 times the original volume of dilute Caustic Soda.

The test material is then stretched, thoroughly washed, neutralised by passing through a weak acid bath, again washed, and dyed with Congo Red.

The mercerised part is dyed a deeper shade in the case where the goods have not been mercerised previously; if, however, the goods have been prepared from mercerised and unmercerised yarn, differences in the depth of shade will be observed, and if the whole piece has been previously mercerised, then the shades run one into the other.

3.

In order to distinguish artificial from natural silk, a thread is moistened on the tongue; artificial silk loses considerably in strength and easily breaks; natural silk however remains unchanged.

To prove the presence of artificial silk, the woven goods to be tested are heated for 10 minutes to 200° C. Nitrocellulose silk then becomes so brittle that it can be completely removed by rubbing the material; natural silk and other natural fibres, on the other hand, remain almost unchanged.

4.

In order to distinguish between artificial fibres produced in different ways, the following reactions are employed:

a) A small quantity of the fibre to be tested is placed in a solution of Diphenylamine in concentrated Sulphuric acid; Collodium silk (Chardonnnet silk) gives the well known blue reaction for Nitric acid.

b) The material is dyed with Methyl Violet; Collodium silk is dyed a dark shade, Glanzstoff and similar products, as well as Viscose remain considerably lighter.

B. DETECTION OF DYESTUFFS FIXED ON THE FIBRE.

Through the kindness of the author, Professor Arthur G. Green of Leeds, we are able to give, on the following pages, tables for the detection of dyestuffs fixed on animal and vegetable fibres,

1. Detection of dyestuffs on Animal Fibres.

The reagents used for this purpose are as follows

1. Dilute Ammonia 1:100.
2. Aqueous Alcoholic Ammonia
1 cc concentrated Ammonia
50 „ Alcohol
50 „ Water
3. Dilute Acetic Acid 1:5.
4. Dilute Alcohol 1:1.
5. Dilute Hydrochloric Acid 1:10.
 6. Caustic Soda
10 gr Solid Caustic Soda in
100 cc Water
 7. Hydrosulphite A.
5% solution of Hydrosulphite NF conc.
 8. Hydrosulphite B:
200 cc Hydrosulphite A
1 „ Glacial Acetic Acid.
 - 9 Persulphate:
cold saturated solution of Potassium Persulphate.
 - 10 Sodium Acetate 5:100.

In making "stripping tests" the degree of stripping is judged by comparing the depth of shade remaining with that of the original pattern. The colour of the stripping solution is misleading, and can scarcely be relied upon as a guide. It is found advantageous in boiling with dilute acetic acid or dilute ammonia to repeat the extraction, as a better stripping is thereby obtained, and further with acid dyestuffs any staining of the cotton by the first strong extract is removed. In testing with dilute ammonia or sodium acetate, the piece is placed in a test-tube with a somewhat smaller piece of white mercerised cotton cloth, and boiled for the time prescribed. If the shade is a pale one the size of the sample should be increased and that of the cotton diminished. The dilute ammonia is replaced by aqueous alcoholic ammonia in the case of the violet and black dyestuffs (Tables III and VII), as in these cases the acid dyestuffs are less easily extracted, and the cotton is more liable to be stained by them.

In making reduction tests, the sample is boiled for $\frac{1}{4}$ —1 minute with the Hydrosulphite, then well rinsed under the tap, and allowed to lie on white paper for an hour or so. With most dyestuffs which form leuco compounds, the colour returns immediately or in a few minutes, but with others a longer time is required. The reaction is accelerated by exposing the pattern to ammonia vapour. If the colour does not return the pattern is heated to boiling in a test-tube with a little water, and potassium persulphate is added drop by drop, carefully avoiding an excess. If this also fails to cause any return of colour, the dyestuff is to be regarded as an azo compound.

Table I. Yellow

| Boil twice for one minute | | | | | | | | |
|---|---|---|--|---|--|---|---|--|
| Much colour is stripped; Basic dyestuff. Boil with Hydrosulphite B. | | | | Little or no colour is stripped. Acid, ammonia (1:100) and | | | | |
| Not decolourised or only very slightly. Treat fibre with conc. H ₂ SO ₄ . | | | | Much colour is stripped but cotton remains white. Acid dyestuff. Boil with hydrosulphite B. | | | | |
| Green fluores- cent solution. Acridine group. | Colourless solution. Boil with dilute HCl (1:10). | | Decolourised. Colour is not restored by an or by persulphate: Azo group | Colour is not affected: Quino- line or Pyron group | Decolourised, and colour does not return on exposure to air or upon oxidation with persulphate: Azo group or N...g... Add conc HCl to the ammoniacal extract. | | | |
| | Com- pletely decol- ourised | Fibre and so- lution pale yellow. | | | No change of colour. | Becomes colour- less. | Becomes red. | Becomes violet or violet red. |
| 1. Phosphine, Azo Phosphine, Ben- zoflavine, Rhodine, Patent Phos- phine, Acridine Yellow, Acridine Orange, &c. | 2. Aniline | 3. Thioflavine T. Methylene Vel- low H. | 4. Chrysoidine, Tannin Orange, New Phosphine, Janus Yellow | 5. Chinoline Yellow, Uragine, Eosine Orange | 6. Flavazine T, Orange G, 2G, R, &c. Flavazine S, L. | 7. Naphthol Yellow S, Martius Vel- low. | 8. Fast Yellow, Indian Yellow, Azo- flavine, Orange II. | 9. Metanil Yellow, Orange IV. |

and Orange Colours.

with 5 per cent. acetic acid.

Salt, or Mordant dyestuff. Boil twice for one minute with dilute a piece of white cotton. Keep the ammoniacal extract.

Little or no colour is stripped. The cotton remains white (mordant dyestuff) or is tinted (salt dyestuff). Boil with 5 per cent sodium acetate and white cotton for two or three minutes.

The cotton is stained: Salt dyestuff.
Boil with hydrosulphite B.

The cotton remains white: Mordant dyestuff. (Confirm by testing ash for metallic mordants.) Boil with hydrosulphite B.

| | | | | | |
|---|---|---|---|---|--|
| Not affected or slightly changed in shade: Thiazol group. | Decolourised. Colour restored by exposure to air or more quickly by persulphate Stilbene group. | Decolourised. Colour not restored by air or by persulphate: Azogroup. | Not affected: Flavone or Ketone group. | Colour changed to yellowish brown: Alizarine group. | Decolourised and colour not restored by air or persulphate: Azogroup. |
| 10. Dianil Pure Yellow HS, Thioflavine S, Chromine, Chloramine Yellow, Chlorophenine, Diamine Fast Yellow B and FF, Thiazol Yellow, Clayton Yellow, &c. Also Turmeric. | 11. Curcumine S, Direct Yellows, Mikado Yellows and Oranges, Stilbene Yellows, Naphthylamine Yellows, Diphenyl Citronne, &c. | 12. Aurophenine O, Chrysophenine Chrysamine, Carbazol Yellow, Cresotine Yellow, Diamine Yellows, Benzo, Congo, or Diamine Oranges, Toluylene Yellow and Orange, Pluto Orange, Dianil Orange, Pyramine Orange, &c | 13. Fustic, Quercitron, Weld ^{*)} , Alizarine Yellow A, Galloflavine, &c. | 14. Alizarine Orange. | 15. Mordant Yellow O, Alizarine Yellows G and R, Anthracene Yellow C, Flavazol, Diamond Flavine, Chrome Orange, Alizarine Yellow GGW. |

^{*)} Weld is partly discharged by acetic acid though the extract remains colourless.

Table II.

Boil twice for one minute with 5

The colour is stripped
Basic dyestuff or Soluble
Red Woods. Boil with
dilute alcohol (1.1) twice for
one minute

Little or no colour is stripped.
Boil twice for one minute with dilute ammonia

Much colour is stripped but cotton remains white:
Acid dye stuff. Boil with hydrosulphite A.

Much of the colour is
stripped: Basic dye-
stuff. Boil with hydro-
sulphite A.

Colour of
wool not
altered.
Pyrone
group.
Acidify the
ammoniacal
extract.

Decolourised. Colour not
restored either on expo-
sure to air or on oxidation
with persulphate. Azo
group. Boil with
dilute bichromate.

Colour unaffected.
Evaporate ammo-
niacal extract and
dissolve in conc
 H_2SO_4 .

Changes to dark maroon or
violet black.

Colour not affected.

Decolourised. Colour returns quickly on
exposure to air.

Decolourised. Colour does not return on
exposure to air but is restored by persulphate.

Decolourised. Colour is not restored either
by air or by persulphate.

Unaffected. Al or Cr are present in ash. Boiling
with dilute ammonia renders the colour much bluer.

Precipitation and disappear-
ance of fluorescence.

No pp and fluorescence
remains

Decolourised. Colour returns on exposure to air:
Azine group.

Decolourised. Colour does not return on exposure
to air but is restored by persulphate.
Triphenylmethane group.

Red Solution.

Violet Solution.

Blue Solution.

Green Solution.

1. Basic dyestuff of Pyrone group e.g.,
Rhodamines, Irianine, Rhodines,
Aniselines, Pyronines &c.

2. Basic dyestuff of Azine group e.g.,
Saffranine, Induline Scarlet,
Rhoduline Red, Rhoduline Pink &c

3. Basic dyestuff of Triphenylmethane
group e.g., Magenta, Isorubine,
Carbazole, New Magenta, &c

4. Basic Azo dyestuff, e.g.,
Janus Red.

5. Soluble red woods, e.g., Brazil
wood, Lima wood, Peach wood, &c.

6. Eosine, Phloxine, Erythrosine,
Saffranine, Rose Bengale, &c.

7. Acid Eosine, or Acid Rhoda-
mine, e.g., Fast Acid Eosine, Fast
Acid Phloxine, Acid Rhodamine,
Acid Rosaniline A.

8. Azocarmine or Rosinduline.

9. Acid Magenta.

10. Nassovia Scarlet O or Palatine
Scarlet.

Crystal Scarlet, Fast Red A, &c

Coccein Scarlet, Fast Red B, &c.

Biebrich Scarlet, &c.

Cromotopes, Azofuchsine, &c.

Red Colours.

per cent. acetic acid.

Acid, Salt, or Mordant Dyestuffs.

(1:100) and a small piece of white cotton. Keep the ammoniacal extract.

| | | | | | | | |
|--|----------------------------------|--|--|--|---|--|------------------------------|
| Some of the colour is stripped and the wool becomes much bluer. Boil with hydrosulphite A. | | Little or no colour is stripped. The cotton remains white (mordant dyestuffs), or is stained (salt dyestuffs). Boil with 5 per cent. sodium acetate and white cotton for 2 or 3 minutes. | | | | | |
| Colour slowly changed to deep yellow. Original colour not restored on exposure to air. | | The cotton is stained: Salt dyestuff. Test ash for chromium. | | The cotton remains white: Mordant dyestuff. (Confirm by testing ash for metallic mordants). Boil with hydrosulphite A. | | | |
| | | Chromium is absent. Treat fibre with conc. sulphuric acid. | | | | | |
| Decolourised. Colour is quickly restored on exposure to air. | | Crimson red Solution. | Cr is present. Solution in conc. H_2SO_4 is red. | Colour not affected. Al in ash. | Colour slowly changed to yellow or orange. | | |
| | | Violet red Solution. | | | | | |
| | | Violet Solution. | | | Decolourised. Colour is restored by persulphate. Al in ash. | | |
| | | Blue Solution. | | | | | |
| | | Greenish blue Solution. | | | | | |
| | | Cr is present. Solution in conc. H_2SO_4 is red. | | | Decolourised. Colour is not restored by persulphate. Cr in ash. | | |
| 11. Cochineal Scarlet. | 12. Orseille, Archil or Cudbear. | 13. <div><div></div><div>Diamine Fast Red, Diamine Fast Red PH.</div><div>Hessian Purple.</div><div>Anthracene Red.</div></div> | | 14. Cochineal Crimson. | 15. Alizarine Reds. | 16. Insoluble red woods, e.g., Camwood or Burwood. | 17. Acid Alizarine Red G, B. |

Table III. Purple

| Boil twice for one minute | | | | | | | |
|---|---|---|---|-----------------|--|---|---|
| Colour is nearly completely stripped. Basic dyestuff. Boil with hydrosulphite A. | | The colour is not stripped: Acid, Salt, or ammonia Much colour is stripped but cotton remains white: Acid dyestuff. Boil with hydrosulphite A. | | | | | |
| Decolourised. The colour returns on exposure to air: Azine, Oxazine, or Thiazine group. | Decolourised. The colour only returns on oxidation with persulphate: Triphenylmethane group | Not altered or only partially decolourised: Pyrone group. | Decolourised. The colour does not return on exposure to air, but is restored upon oxidation with persulphate: Triphenylmethane group. | | The ammoniacal extract is colourless, but becomes violet on acidifying. Spot fibre with conc. HCl. | Decolourised. The colour returns on exposure to air: Azine, Oxazine, or Thiazine group. | Decolourised. The colour is not restored either by exposure to air or by oxidation with persulphate: Azo group. |
| | | | The ammoniacal extract is violet or purple. | | | | |
| | | | | | Becomes green. | No change. | |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
| Neutral Violet, Rhoduline Violet, Rosolane, Iris Violet, Methylene Violet, Tannin Heliotrope, &c. | Methyl Violet, Crystal Violet, Hofmann Violet, Benzyl Violet, &c. | Fast Acid Violets, Violamines. | Acid Violets, Formyl Violets, &c | Alkali Violets. | Red Shade Soluble Blues. | Red Shade Induline or Fast Blue R, &c. | Lanacyl Violet, Victoria Violet, &c. |

and Violet Colours.

with 5 per cent. acetic acid.

Mordant dyestuffs Boil twice for one minute with aqueous alcoholic and white cotton.

Little or no colour is stripped. The cotton remains white (mordant dyestuffs) or is tinted (salt dyestuffs). Boil with sodium acetate and white cotton for two or three minutes.

| The cotton remains white: Mordant colour (Confirm by testing for metallic mordants in ash). Boil with hydrosulphite A. | | | | | | |
|---|-----------------------------------|---|--|---|---|--|
| The cotton is stained: Salt dyestuff. | Colour not altered: Pyrone group. | Colour changed to brown: Alizarine group. Boil with dilute HCl. | | Decolourised. Colour returns on exposure to air: Oxazine group. | Decolourised. Colour does not return on exposure to air, but is restored by per-sulphate: Triphenyl-methane group | Decolourised. Colour is not restored either by exposure to air or by oxidation with per-sulphate: Azo group. |
| | | Fibre and solution yellow. | Fibre and solution red or reddish brown. | | | |
| 9. Dianil Violet H, Hessian Violet, Diamine Violet, Oxamine Violet, Benzo Fast Violet, Columbia Violet, Oxydianiline Violet, Chlorantine Violet, &c. | 10. Galleine. | 11. Alizarine on Iron *) or Chrome. | 12. Alizarine Bordeaux, Alizarine Claret R. | 13. Gallocyanine, Prune, Celestine Blue, &c. | 14. Chrome Violet. | 15. Acid Alizarine Grenade R. Acid Alizarine Violet N. |

*) Alizarine on iron becomes brown on boiling with 5 per cent. acetic acid.

Table IV.

| | | | | | |
|--|--|---|--|--|--|
| | | Boil twice for one minute with 5 | | Little or no colour is | |
| Much colour is stripped. Boil with dilute alcohol (1 1) twice for one minute. | | Boil twice for one minute with dilute ammonia | | Much colour is stripped but cotton remains dyestuff. Boil with hydrosul- | |
| Much colour is stripped. Basic dyestuff. Boil with hydrosul- phite A. | | Decolourised and colour restored on exposure to air: Azine, Oxazine, Thiazine, and Indigo group. Also Prussian Blue. | | Decolourised. Colour does not return on exposure to air but is restored by persulphate. Triphenylmethane group. | |
| Decolourised. Original colour returns on exposure to air: Azine, Oxazine, or Thiazine group | Decolourised. A violet colour returns on exposure to air: Saffanine Azo colour. | Decolourised. The colour does not return on exposure to air but is restored by persul- phate. Triphenylmethane group | | Unaffected. Al or Cr or both are present in ash; The blue is changed to brick red on spotting with HCl. | |
| | | Ammon. extract is blue and on adding NaOH, | | Ammon. extract is colourless. Fe in ash. | |
| Decolourised. A violet colour returns on exposure to air: Saffanine Azo colour. | Decolourised. The colour does not return on exposure to air but is restored by persul- phate. Triphenylmethane group | at once becomes yellow. | | becomes violet on heating. | |
| | | Ammon. extract is colourless. Fe in ash. | | Ammon. extract is colourless but becomes blue on acidifying. | |
| Decolourised. Original colour returns on exposure to air: Azine, Oxazine, or Thiazine group | | Decolourised. The colour does not return on exposure to air but is restored by persul- phate. Triphenylmethane group | | Unaffected. Al or Cr or both are present in ash; The blue is changed to brick red on spotting with HCl. | |
| Decolourised. A violet colour returns on exposure to air: Saffanine Azo colour. | | Decolourised. The colour does not return on exposure to air but is restored by persul- phate. Triphenylmethane group | | Unaffected. Al or Cr or both are present in ash; The blue is changed to brick red on spotting with HCl. | |
| Decolourised. The colour does not return on exposure to air but is restored by persul- phate. Triphenylmethane group | | Unaffected. Al or Cr or both are present in ash; The blue is changed to brick red on spotting with HCl. | | Ammon. extract is colourless but becomes blue on acidifying. | |
| Unaffected. Al or Cr or both are present in ash; The blue is changed to brick red on spotting with HCl. | | Ammon. extract is colourless but becomes blue on acidifying. | | Ammon. extract is colourless but becomes blue on acidifying. | |
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| Ammon. extract is colourless but | | | | | |

Blue Colours.

per cent. acetic acid.

stripped: Acid, Salt or Mordant dyestuff.

(1:100) and small piece of white cotton. Keep the ammoniacal extract

white: Acid
phite A.

Little or no colour is stripped. The cotton remains white (mordant dyestuff) or is tinted (salt dyestuff). Boil with 5 per cent. sodium acetate and white cotton for 2 or 3 minutes.

used. Colour is not restored either by air or by persulphate: Azo group.

Not decolourised but colour changed to bluish red :
 Alizarine group.

The cotton is stained; Salt dyestuff. On reduction with hydrosulphite A the colour is not restored either by an α persulphate. Azo group.

The cotton remains white Boil with a little aniline oil.

the solution which on evaporation to dryness leaves a residue which sublimes in violet vapours on heating.

The aniline solution is light brown or colourless: Mordant dyestuff. Confirm by testing ash for metallic mordants. Boil with hydrosulphite A.

Colour of wool unaltered:
Alizarine group

Colour changed to dark brown becoming blue again on exposure to air; Alizarine group.

Decolourised,
but colour
returns on ex-
posure to air:
Oxazine or
Thiazine
group.
Treat fibre
with conc.
 H_2SO_4 .

Green
solutionViolet
solution

Decolourised Colour does not return on exposure to air, but is restored by persulphate Triphenylmethane group.

Decolourised. Colour is not restored
either by air or by persulphate.
Azo group.

An Acid Azo Blue, c. g., Lanacyl Blue, Azo Acid Blue, Azo Merino Blue, Azo Navy Blue, &c. 11.

Alizarine Direct Blue EB, Alizarine Saphire, Alizarine Astrole, Alizarine Trisol, &c.

13.
Dianil, Diamine, Benzo, or Chicago
Blues, Sulphone Cyannes, &c.

Indigo. 14

15.
An Alizaune Cyanine, or
Anthracene Blue.

16.
An Alizaine Blue
(anthraquinone-quinoline).

Brilliant Alizarine Blue.

18.
Galloyannes, Celestine Blue,
Gallamine Blue, Prunc, &c.

19
Chrome Blue.

A Mordant Azo Blue, e. g., Cyprus Blue, Peril Wool Blue, Anthracene Chrome Blue, Chromotrope Blue, &c.

Table V.

| Boil twice for one minute | | | |
|--|---|--|--|
| The colour is stripped: Basic dyestuff. Boil with hydrosulphite A. | | The colour is not stripped: Acid ammonium | |
| 1. | A Safranin-Azo Colour, e. g., Janus Green or Diazine Green. | Decolourised. A dark violet colour returns on exposure to air; Safranin Azo colour. | |
| 2. | A Basic Green of the Azine, Thiazine, or Oxazine group, e. g., Fast Green M, Azine Green, Capri Green, Methylene Green, &c. | | Decolourised. Original colour returns on exposure to air; Azine, Oxazine or Thiazine group. |
| 3. | A Basic Green of the Triphenylmethane group, e. g., Malachite Green, Brilliant Green, Setoglaurine, Fast Green, &c. | | |
| 4. | Azine Green S. | Decolourised. Colour returns on exposure to air: Azine, Oxazine, or Thiazine group. | |
| 5. | Acid Greens, Light Green, Guinea Green, Wool Green, Neptune Green, Naphthalene Green V, &c. | | Decolourised. Colour does not return on exposure to air but is restored by persulphate: Triphenylmethane group. |
| 6. | Chiefly Mixtures of an Azo Blue and Yellow. | | |

Green Colours.

with 5 per cent. acetic acid.

Salt, or Mordant dyestuff. Boil twice for one minute with dilute (1:100) and a small piece of white cotton.

Little or no colour is stripped. The cotton remains white (mordant dyestuff) or is stained (salt dyestuff). Boil for 2 or 3 minutes with 5 per cent. sodium acetate and a piece of white cotton.

| The cotton remains white ^{*)} . Mordant dyestuff. Confirm by testing for metallic mordant in ash. Boil with hydrosulphite A. | | | | | |
|---|---------------------------------|--|---|---|--|
| The cotton is deeply stained; Salt dyestuff. | | Colour changes to brown Alizarine group. | | Decolourised (or changed to light buff). | |
| | | Original colour returns on exposure to air. | Original colour does not return on exposure to air, but is restored by persulphate. | Colour returns on exposure to air: Oxazine or Thiazine group. | Colour does not return on exposure to air or upon oxidation with persulphate: Nitroso or Azo group. Boil with conc. hydrochloric acid. |
| | | | | | Fibre and solution light brown: Nitroso group. Fibre blue and solution colourless: Azo group. |
| 7. | 8. | 9. | 10. | 11. | 12. |
| Dianil Green, Diamine Green, Columbia Green, Chloramine Green, Benzo Green, &c. | Cocculine or Alizarine Green S. | Alizarine Direct Green G, Alizarine Cyanine Green or Alizarine Viridine. | Alizarine Green G or B (Oxazine Group). | Nitroso Mordant Colours e.g., Gambines, Dioxine, Dark Green Naphthol Green, &c. | Azo mordant Colour, e.g., Diamond Green, Chrome Patent Green, &c. |

^{*)} With azo mordant colours the cotton may be slightly tinted, especially if the fixation by chrome is not complete.

Table VI.

| Boil twice for one minute | |
|--|---|
| Little or no colour is stripped for one | |
| Little or no colour is stripped: 5 per | |
| The cotton is stained: Salt dyestuff. Boil with Hydrosulphite A. | |
| 1 | Much colour is stripped. Basic dyestuff. On boiling with Hydrosulphite A decolourised, and colour does not return on exposure to air or on oxidation with persulphate: Azo group. |
| | Much colour is stripped. Acid dyestuff. On boiling with Hydrosulphite A decolourised, and colour does not return on exposure to air or on oxidation with persulphate: Azo group. |
| 2 | Decolourised, but colour not restored by air or persulphate: Azo group. Test ash for chromium to ascertain if chromed (Cloth Brown, Chrome Brown, &c.). |
| | Decolourised, but colour returns slowly on exposure to air or quickly on oxidation with persulphate: Stilbene group. |
| 3 | Dianil Browns, Diamine Browns, Benzo Browns, Toluylene Browns, Congo Browns, Hessian Browns, Columbia Browns, Sulphone Browns, &c. |
| 4 | Mikado Browns (Stilbene Group) |

Brown Colours.

with 5 per cent. acetic acid.

Acid, Salt, or Mordant dyestuff. Boil twice minute with dilute ammonia.

Salt or Mordant dyestuff. Boil for two or three minutes with cent. sodium acetate and white cotton.

The cotton remains white; Mordant dyestuff.
Confirm by testing for metallic mordants in ash. Boil with Hydrosulphite A.

| Colour not changed. Boil with dilute hydrochloric acid (1:10). | | Decolourised or changed to pale buff or light brown. | |
|--|---------------------|--|--|
| Colour is stripped. | Colour not stripped | Colour returns slowly on exposure to air or quickly on oxidation with persulphate. | Colour not restored either by air or persulphate. Azo group. |
| 5. Alizarine Brown, Anthragallol Anthracene Brown. | 6. Cutch. | 7. Chromogene I | 8. Acid Alizarine Brown RP, B, BB, &c., Anthracene acid Browns, Acid Anthracene Brown, Palatine Chrome Brown, Acid Chrome Brown, Diamond Brown, Metachrome Brown, &c., also Manganese Bistre (Mn in ash). |

Table VII. Black

| | | Boil twice for one minute | |
|---|---|---|------------------------|
| | | The colour is not stripped. Acid, Salt, or alcoholic ammonia | |
| | | The colour is not stripped. acetate | |
| | | The cotton is stained: Salt and Azo Mordant dyestuff Permanently decolourised by Hydrosulphite A. Test ash for chromium. | |
| | | The cotton mordant.) | |
| | | Fibre blue and solution crimson. Test for indigo by boiling with a little aniline, blue solution, which on evaporation to dryness gives residue subliming in violet vapour. | |
| 1 | Janus Black, Methylene Grey, Diazine Black, &c. | Much colour is stripped: Basic dyestuff (N. B. Logwood black on Fe mordant also becomes much paler though solution is not coloured) | |
| 2 | Amido Black, Naphthol Black, Naphthylamine Black, Palatine Black, Nerol, Azo Acid Black, Azo Merino Black, &c. | Much colour is stripped but the cotton remains white: Acid dyestuff. On boiling with Hydrosulphite A the colour is permanently discharged | |
| 3 | Patent Diamid Black, Diamid Blacks, Union Black, Half Wool Black, Columbia Black, Diamine Blacks, Carbide Black, &c. | Cr is absent: Salt dyestuffs, | Mordant Azo dyestuffs. |
| 4 | Acid Alizarine Black, Anthracene Chrome Blacks, Palatine Chrome Black, Chromotropes, Acid Chrome Black, Chromate Black, &c. | Cr is present: | |
| 5 | A "Vatted Black," (indigo and logwood). | | |

and Grey Colours.

with 5 per cent. acetic acid.

Mordant dyestuff. Boil twice for one minute with aqueous and small piece of white cotton.

Salt and Mordant dyestuffs. Boil with 5 per cent. sodium and small piece of white cotton.

remains white: Mordant dyestuffs. (Confirm by testing ash for metallic Boil with dilute hydrochloric acid (1:10).

| Not affected. Boil with Hydrosulphite A. | | | | | |
|--|---------------------------------------|--|--|--|---------------------|
| Fibre and solution crimson. | Fibre and solution pale brown. | Becomes brown. Original colour slowly returns on exposure to air | Decolourised. Colour is not restored by exposure to air or by persulphate. | Unaffected. Treat fibre with conc. H_2SO_4 . | |
| | | | | Blue Solution. | Colourless Solution |
| 6. Logwood on Chrome. | 7. Logwood on Iron or Bonser's Black. | 8. Alizarine Blacks, Alizarine Blue Black SW., Naphthazarine. | 9. Diamond Blacks | 10. Alizarine Cyanine Black. | 11. Aniline Black. |

2. Detection of dyestuffs on Vegetable Fibres.

The following reagents are used:

Weak Ammonia solution 1:100.

Dilute Caustic Soda:

10 gr Caustic Soda in 100 cc Water.

Saline Caustic Soda.

10 cc Caustic Soda solution (35—40% NaOH) to
100 cc saturated solution of Common Salt.

Formic Acid 90%.

Weak Formic Acid 1:100.

Dilute Hydrochloric Acid 1:20.

Soap Solution:

10 gr Soap in
300 cc Water.

Tannin Solution:

10 gr Tannin and 10 gr Sodium Acetate in
100 cc Water.

Bleaching Powder Solution:

Fresh solution of 5° Tw.

Hydrosulphite A:

5% solution of Hydrosulphite NF conc.

Hydrosulphite B:

The preceding slightly acidified by addition of
1 cc Glacial Acetic Acid to 200 cc of Solution.

Hydrosulphite X:

Dissolve 50 gr of Hydrosulphite NF conc. in 125 cc of hot water. Grind 1 gr of Anthraquinone (precipitated not sublimed) to a fine powder, and reduce to a smooth paste with a little of the Hydrosulphite solution. Add this paste to the remaining solution hot, and heat the whole for 1—2 minutes at about 90° C. Then dilute with cold water to 500 cc and after standing till cold add 1½ cc of Glacial Acetic Acid. Keep in a well stoppered bottle with greased stopper.

Persulphate:

Cold saturated solution of Ammonium persulphate.

Acid Stannous Chloride

100 gr Stannous Chloride, 100 cc Hydrochloric Acid 30% and
50 cc Water. In testing for Sulphide colours this reagent may be
replaced if desired by a strong solution of Titanous Chloride.

Pyridine:

The commercial product.

When carrying out tests, the following points are to be observed:

Stripping Test for Acid Colours.

A few salt dyestuffs are partially stripped by weak ammonia,
and may thus give rise to the impression that they are acid colours.

To avoid this error it is advisable to add a small piece of white cotton when carrying out the test. If the dyestuff is an acid one the cotton is either not tinted or becomes white on boiling a second time with weak ammonia.

Transference of Basic Colours to Wool.

The tannin mordant is first removed, as in testing for a basic colour, by boiling the pattern for half a minute with saline caustic soda. It is then well washed to remove all alkali, and is boiled with a piece of white wool (half the size of the cotton or less) in a little plain water for one or two minutes. In most cases the dye base will leave the cotton almost entirely, and dye the wool a full shade. If the colour does not develop on the wool one or two drops of weak formic acid (1:100) may be added. In the case of a few dyestuffs which are more difficult to strip (e. g. basic greys), it is necessary to extract the colour with dilute hydrochloric acid (1:20), carefully neutralising the extract with ammonia before adding the wool.

Transference of Acid Colours to Wool.

The cotton is simply boiled with a small piece of wool and weak formic acid (1:100).

Tannin Test for Basic Colours.

Add a few drops of Tannin solution to the formic acid extract. Shake well, and if the precipitate does not form at once allow to stand a few minutes. Some colouring matters, such as Rosazaine, Gallocyanine, and Chrome colours of the Rosaniline series (which contain carboxyl or hydroxyl groups in addition to basic groups) only precipitate slowly, whilst the precipitate being more finely divided is sometimes difficult to see.

Reduction and Reoxidation Tests.

The reduction with Hydrosulphite X is carried out by boiling the sample with the reagent for $\frac{1}{2}$ —2 mins. The azines, thiazines, oxazines, &c., and most of the azo dyestuffs are fully reduced in about half a minute, but the insoluble azo colours and some salt dyestuffs require longer boiling to complete their reduction. In testing by air, the reduced sample may be exposed to the fumes from an ammonia bottle, which in many cases accelerates oxidation.

Table I. Yellow

| The colour is stripped. Boil with acidified water and small piece of white wool. | | | The colour is not stripped. Boil for half minute | | | | | | |
|--|---|--------------------------------------|---|--|-------------------------------------|---|--|---|---|
| Colour not transferred to the wool. Sn is present in ash. | Colour is transferred to the wool: Acid dyestuff. Boil wool with Hydrosulphite B. | | The colour is completely destroyed, both alkaline and acid solutions and the fibre being colourless. Treat original fibre with cold ammonium sulphide | | | The colour is completely or largely stripped, giving a coloured acid extract, which is precipitated by Tannin solution. Basic dyestuff. Transfer to wool and boil with Hydrosulphite B. | | | |
| | Pyrene or Quinoline group. | Permanently decolourised. Azo group. | Fibre blackened. Cr present in ash | Fibre is not blackened. Boil with Hydrosulphite X. | | Wool is not decolourised. Boil cotton with hydrochloric acid (1.20). | The wool is not decolourised. The conc. H_2SO_4 and alcoholic solutions are fluorescent. Acridine group. | Wool is permanently decolourised: Azo group. | |
| | | | | Not decolourised. Test for Al in ash. | Decolourised | | | | |
| 1. Persian Berries on tin mordant. | 2. Chinoline Yellow, Eosine Orange. | 3. Indian Yellow, Orange IV., &c. | 4. Chrome Yellow or Chrome Orange (Lead Chromate). | 5. Alizarine Yellow A. | 6. Methylene Yellow, Thioflavine T. | 7. Flavinduline. | 8. Auramine. | 9. Phosphine, Benzoflavine, Acridine Yellow. Acridine Orange, &c. | 10. Chrysoidine, Janus Yellow, Tannin Orange, &c. |

1. Brilliant Yellow is largely stripped by weak ammonia, but if white cotton is present it will be stained.
2. Sulphide Yellows of the thiazol class, such as Katigene Yellow 2G, Pyrogene Yellow, &c., stain white cotton slightly when boiled in soap.
3. Auramine G is almost completely stripped by saline caustic soda and the formic extract therefore gives no precipitate with tannin solution.

and Orange Colours.

ammonia (1:100).

with Saline caustic soda, rinse and boil twice with weak formic acid (1:100).

The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Fe^{2+} .

Decolourised or becomes light yellow. Original colour is not restored by air oxidation.

Azo dyestuff (including the Stilbene group).

Boil with soap solution and white
mercerized cotton.

The colour is unaffected or changed in shade becoming lighter, browner or bluer. If altered in shade exposure to air restores the original colour. Apply the lead acetate test.

No H_2S is evolved. Boil with soap solution and white mercerized cotton.

White cotton is
stained:
Salt dyestuff.

White cotton is not stained. Boil with pyridine

H_2S is evolved:
Sulphide dyestuff.

The white cotton is stained:
Thiazol Salt dyestuff.

The white cotton is not stained. Mordant or Vat dyestuff. Boil with 90% formic acid. Also test ash for metallic mordant.

Colour stripped by formic acid, Al or Cr in ash; Mordant dyestuff.

Colour not stripped
by formic acid. No
mordant in ash;
Vat dyestuff.

Fibre after reduction is light yellow and can be diazotised and developed red with beta-naphthol; Pimuline A/o Colour.

Fibre after reduction
is colourless: Salt
Azo dyestuff

Colour is stripped.
Insoluble Azo
colour.

Colour is not stripped. Cr
present in the ash: Az
Mordant dyestuff

11.
Pruniline developed with Phe-
nol or with Resorcinol, Cotton
Yellow G and R, Oriol Yellow,
Diast Yellow, &c

12.
Chrysophenine, Chrysamine, To-
luylene Yellow and Orange, Stil-
bene Yellows and Oranges, Benzo,
Congo, Diamine, and Diam Yel-
lows and Oranges, Pyramine
Orange, &c.

13.
Metanililine Orange or Nitro-
toluidine Orange (Formed on
Fibre)

Chrome Orange, Alizarine Yellow R, GG, &c, Diamond Flavine, Flavazol, &c

13.
Yellows and Oranges of the Im-
medial, Katigene, Pyrogene,
Thiogene, Sulphur, &c, series.

16.
Oxydianil Yellow, Chlorophenine,
Chloramine Yellow, Diamine Fast
Yellow B, FF, and C, Clayton
Yellow, Thiazol Yellow, Thio-
flavine S, &c. Primuline Devel-
oped with Hypochlorite.

Persian Berries on Al or Cl Mordants, Alizarine Orange on Al Mordant.

Helindone Orange R, Helmdone Yellow 3G, Anthraflavone G, Algole Yellow 3G and R, Algole Orange R, Indanthrene Yellow, Indanthrene Orange RT and Gold-Orange, Indanthrene Copper, Cibacron Yellow R and Orange R.

4. Diamond Flavine, if not fully fixed, may stain cotton from a soap solution.

5. Helindone Yellow and Helindone Orange give yellow vapours on heating the fibre in a dry tube. Upon reduction with Hydrosulphite X, Helindone Yellow becomes olive, Helindone Orange colourless.

6 Indanthrene Yellow (Flavanthrene) is reduced by Hydrosulphite X to a blue, Indanthrene Golden Orange remains unchanged.

Red Colours.

ammonia 1:100).

caustic soda, rinse, and boil twice for one minute with weak formic acid (1:100).

or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.

not restored by air or group. Boil with mercerised cotton.

Becomes yellow or colourless. Colour returns on exposure to air: Azine or Indigo group. Apply lead acetate test. Also heat fibre in dry tube.

Colour changed to greenish yellow (not restored to original colour by air), which can be diazotised and developed red with betanaphthol. Primuline Azo Colour.

Colour unaffected or changed to maroon or brown. Original colour restored on exposure to air: Anthracene group. Boil with 90% formic acid. Also test ash for mordant.

The white cotton is not stained. Boil with pyridine.

The colour is stripped: Insoluble Azo Colour.

The colour is not stripped. Cr in ash: Mordant Azo dyestuff.

H₂S is evolved. No coloured vapours: Sulphide dyestuff.

No H₂S is evolved. Red vapours on heating: Indigoid Vat dyestuff.

Colour stripped by formic acid. Al in ash: Anthracene Mordant dyestuff.

Colour but little affected by formic acid. Cr in ash: Anthracene Mordant dyestuff. Cr absent: Anthracene Vat dyestuff.

| | |
|-----|---|
| 9. | Azophor Red, Azophor Pink, Favantraniline Red, Alphanaphthylamine Claret, Chloraniline Pink, Nitroamidine Pink, Azo Pink, Blue Red. |
| 10. | Chrome Red, Brilliant Chrome Red, Chrome Bordeaux, &c. |
| 11. | Thiogene Rubine, &c. |
| 12. | Helindone Red B and 3B, Helindone Scarlet S, Helindone Fast Scarlet R, Thioindigo Red B, Thioindigo Scarlet, Vat Red B, A.S.F. Algole Red 5G and Scarlet G, Algole Pink R, Ciba Red G and Scarlet G, Ciba Bordeaux B. |
| 13. | Primuline Developed with Betanaphthol or with R-Salt. |
| 14. | Turkey Red, Alizarine Red, Alizarine Pink, Alizarine Claret. |
| 15. | Alizarine, Purpurines or Alizarine Claret on Cr Mordant. |
| 16. | Algole Red B, Indanthrene Red, Indanthrene Claret. |

Table III. Purple

| | | Boil with Weak Saline | | | | | | | |
|---|------------------------------------|---|---|--|-----------------------|--|----------------|---|------------------------------------|
| The colour is stripped: Acid dyestuff. The colour transferred to wool is decolourised by Hydrosulphite A and restored by persulphate: Triphenylmethane group. | | The colour is not stripped. Boil for half minute with Saline | | | | The colour solution. | | The colour solution. | |
| | | The colour is completely or largely stripped giving a coloured acid extract, which is precipitated by Tannin solution: Basic dyestuff (on tannin or other mordant) or Basic mordant dyestuff. Boil with Saline caustic soda, rinse well, and boil with small piece of white wool and plain water. | | | | Decolourised air or persulphate on Boil with merceri. | | | |
| | | The wool is dyed. Basic dyestuff Boil wool with Hydrosulphite A. | | | | The wool is not dyed Crispresent in ash: Basic Mordant dyestuff. Boil cotton with Hydrosulphite X | | The white cotton is stained: Salt dyestuff. Test ash for Cr and Cu. | |
| The ammoniacal solution is colourless, but becomes blue on acidifying. | The ammoniacal solution is violet. | Not decolourised: Pyrone group. | | Decolourised. Colour returns on exposure to air: Azine (oxazine or thiazine) group. | | Decolourised. Colour does not return in air, but is restored by persulphate: Triphenylmethane group. | | Decolourised. Colour is not restored by air or persulphate: Azo group. | |
| | | Decolourised. Colour returns on exposure to air: Azine (oxazine or thiazine) group. | | Decolourised. Colour does not return in air, but is restored by persulphate: Triphenylmethane group. | | Decolourised. Colour returns on exposure to air: Oxazine group. | | Decolourised only slowly. Colour does not return in air, but is restored by persulphate: Triphenylmethane group. | |
| Red shades of Soluble and Alkali Blues. | Acid Violets, Formyl Violets, &c. | No Cr or Cu present: Azo Salt dyestuff | | No Cr or Cu present: Azo Salt dyestuff | | No Cr or Cu present: Azo Salt dyestuff | | No Cr or Cu present: Azo Salt dyestuff | |
| | | Cr or Cu present: Azo Salt dyestuff after treatment | | Cr or Cu present: Azo Salt dyestuff after treatment | | Cr or Cu present: Azo Salt dyestuff after treatment | | Cr or Cu present: Azo Salt dyestuff after treatment | |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
| Red shades of Soluble and Alkali Blues. | Acid Violets, Formyl Violets, &c. | Anisoline. | Methylene Violet, Rhodamine Violet, Iris Violet, Neutral Violet, Tannin Heliotrope, &c. | Methyl Violets, Ethyl Violet, Benzyl Violet, Crystal Violet, &c. | Janus Claret Red, &c. | Chromoglaucine, Philochromine, Galloxyamine, Gallamine Blue, Prune, &c. | Chrome Violet. | Violets of the Diamine, Benzidine, Congo, Hessian, Columbian, Chlorazol, Chlorantine, Diamil, Oxamine, and Rosanthrine series | The preceding Coppered or Chromed. |

1. Alizaine on chromium becomes rather browner on reduction with Hydro

and Violet Colours.

ammonia (1:100).

caustic soda, rinse, and boil twice for one minute with weak formic acid (1:100).

is not stripped or the acid extract is not precipitated by Tannin
Reduce with Hydrosulphite X.

and colour not restored by phate. Azo group or Al-iron (decoloured slowly). soap solution and white sed cotton.

Decoloured or yellowish Colour restored on exposure to air: Azine, Oxazine, Thiazine or Indigoid groups. Apply lead acetate test. Also heat fibre in dry test tube.

The colour is unaffected or only changed in shade, being restored to original on exposure to air: Pyrone or Anthracene group. Test ash for mordant

The white cotton is not stained. Boil with Hydrochloric acid (1:20).

Colour destroyed, giving yellow solution. Fe present in ash: Alizarine Red on Fe mordant.

The colour is not stripped. Boil with pyridine.

The colour is stripped: Insoluble Azo colour
The colour is not stripped. Cr present in ash Mordant Azo dyestuff.

H₂S is evolved. No coloured vapours on heating: Sulphide dyestuff

No H₂S is evolved. Test ash for mordant.

Cr is present. No coloured vapours on heating: Mordant Oxazine dyestuff (not falling in group 7).

Cr is absent. Coloured vapours on heating: Indigoid dyestuff.

Al or Cr is present. Mordant dyestuff.

Mordants are absent. Apply lead acetate test.

The colour on reduction is unchanged.

The colour on reduction is browner or darker.

H₂S is evolved: Sulphide dyestuff.

No H₂S is evolved. Anthracene Vat dyestuff.

| | | | | | | | | | | | | | | | | | | | |
|-----|-------------------|-----|-----------------------------|-----|------------------------------------|-----|---------------------------------------|-----|-----------------------------------|-----|--|-----|---|-----|---|-----|------------------------|-----|-------------------------------------|
| 11. | Alizarine Violet. | 12. | Alpha Naphthylamine Claret. | 13. | Chrome Bordeaux, Chrome Prune, &c. | 14. | Thiogene Violet, Katigene Violet, &c. | 15. | Gallamine Blue, Gallocyanine, &c. | 16. | Ciba Violet, Ciba Heliotrope, Thioindigo Violet. | 17. | Gallene Alizarine Violet, Alizarine Claret, Alizarine Cyclamine, Alizarine on Cr mordant. | 18. | Alizarine Cyanine 3R, Alizarine Claret. | 19. | Thiogene Dark Red, &c. | 20. | Indanthrene Violet or Violanthrene. |
|-----|-------------------|-----|-----------------------------|-----|------------------------------------|-----|---------------------------------------|-----|-----------------------------------|-----|--|-----|---|-----|---|-----|------------------------|-----|-------------------------------------|

sulphite X.

Table IV.

| | | Boil with Weak | |
|----|---|--|--|
| | | The colour is not stripped. Boil for half minute with | The colour Reduce |
| | | | |
| 1. | Alkali or Soluble Blues. | The extract is colourless, but becomes blue on acidification. Transferred to wool, the blue is decolourised by Hydrosulphite A, and restored by persulphate: Triphenylmethane group. | The colour is completely or largely stripped, giving a coloured acid extract, which is precipitated by Tannin solution. Basic dyestuff (on tannin or other mordant) or Basic Mordant dyestuff. Boil with Saline caustic soda, rinse well, and boil with small piece of white wool and plain water. |
| | | | |
| 2. | Prussian Blue. | The extract is colourless and remains so on acidification. FeCl_3 gives a blue precipitate. | The wool is dyed: Basic dyestuff. Boil wool with Hydrosulphite A. |
| | | | |
| 3. | Methylene Blue, New Methylene Blue, Nile Blue, Capri Blue, Metaphenylene Blue, Meldola's Blue, Fast Blue, Cresyl Blue, Rhoduline Blue, Nitroso Blue, New Ethyl Blue &c. | Decolourised. Colour returns on exposure to air: Azane, Oxazine, or Thiazine group. | The wool is not dyed: Cr present in ash. Basic Mordant dyestuff. Boil cotton with Hydrosulphite X. |
| | | | |
| 4. | Janus Blue, Indoline, Blue Naphthindione Blue, Indophene Blue &c. | Colour changes to red just before being decolourised. Colour returns violet or blue. Safranin Azo dyestuff. | The white cotton is stained. Salt dyestuff. Test ash for Cr and Cu. |
| | | | |
| 5. | Victoria Blue, Night Blue, Turquoise Blue, Setacyanine, &c. | Decolourised. Colour does not return on exposure to air, but is restored by persulphate. Triphenylmethane group. | No Cr or Cu present. Azo Salt dyestuff. |
| | | | |
| 6. | Gallocyanine, Celestine Blue, Prune, &c. | Decolourised. Colour returns on exposure to air. Oxazine group. | Cr or Cu present: Azo Salt dyestuff after treated. |
| | | | |
| 7. | Chrome Blue | Decolourised slowly. Colour restored only by persulphate. Triphenylmethane group. | |
| | | | |
| 8. | Blues of the Diamine, Benzo, Congo, Columbia, Chlorazol, Diamyl, Oxamine, Chicago, &c., Series. | | |
| | | | |
| 9. | The preceding Coppered or Chromed. | | |
| | | | |

1. Alkali Blue dyed on a tannin and tin mordant is only partly stripped by

Blue Colours.

ammonia (1:100).

Saline caustic soda, rinse, and boil twice with weak formic acid (1:100).

is not stripped or the acid extract is not precipitated by Tannin solution, with Hydrosulphite X.

| | | | | | | |
|--|---|--|--|--|--|--|
| Colour not rephare: Azo solution and cotton. | | Decolourised or yellowish. Colour is restored on exposure to air: Azine, Oxazine, Thiazine, or Indigo group. Apply lead acetate test | | Colour unaffected or becomes darker, browner, &c. the original colour being restored on exposure to air: Anthracene Mordant or Anthracene Vat dyestuff (also Ultramarine). Boil with 90 per cent. formic acid. | | |
| 10. Dianisidine Blue. | 11. Blues of the Immedial, Katigene, Thugene, Pyrogene, Sulphur, &c., Series | The white cotton is not stained. Colour is stripped by boiling pyridine: Insoluble Azo colour. | | The colour is stripped. Al in ash. Apply lead acetate test | | |
| | | H ₂ S is evolved Sulphide dyestuff. | | The colour is not much affected. Test ash for Cr. | | |
| | | No H ₂ S is evolved: Heat fibre carefully in dry test-tube | | H ₂ S is evolved | | |
| | | Violet vapours evolved. Indigoid dyestuff. | | No H ₂ S evolved. Alizarine dyestuff on Al | | |
| 12. Indigo natural and synthetic, Indigo MJB, 2B, 4B, 5B, 6B and T, Ciba Blue, Bromindigo FB. | | No coloured vapour. Cr in ash: Mordant Thiazine or Oxazine (not falling in group 6). | | Colour changed to greenish yellow, which can be diazotised and developed red with betanaphthol: Primuline Azo colour. | | Cr present in ash. Alizarine dyestuff on Cr. |
| 13. Brilliant Alizarine Blue, Delphine Blue, Gallophenine, &c. | | Colour changed to greenish yellow, which can be diazotised and developed red with betanaphthol: Primuline Azo colour. | | Cr absent: Anthracene Vat dyestuff. | | |
| 14. Primuline developed with Naphthylamine ether. | | H ₂ S is evolved | | | | |
| 15. Ultramarine. | | No H ₂ S evolved. Alizarine dyestuff on Al | | | | |
| 16. Anthrol Blue, Alizarine Cyanines or Anthracene Blues on Al mordant. | Cr present in ash. Alizarine dyestuff on Cr. | | | | | |
| 17. Anthrol Blue, Alizarine Blue, Alizarine Cyanines or Anthracene Blues on Cr mordant. | | | | | | |
| 18. Indanthrene Blues, Algal Blues. | | | | | | |

weak ammonia, the solution being colourless.

Table V.

| | | Boil with Weak | |
|---|---|--|--|
| | | The colour is not stripped. Boil for half minute with | |
| The colour is stripped: Acid dyestuff. The colour transferred to wool is decolourised by Hydrosulphite A and restored by persulphate: Triphenylmethane group. | | The colour is not stripped or the | |
| | | Decolourised and colour not restored by air or persulphate: Azo or Nitroso group. Boil with soap solution and white mercerised cotton. | |
| | | The white cotton is stained: Salt dyestuff. Test ash for Cr and Cu. | |
| | | The white cotton is not stained. Boil with hydrochloric acid (1:20). | |
| | | The wool is dyed: Basic dyestuff. Boil wool with Hydrosulphite A. | |
| | | The wool is not dyed. Cr in ash. Cotton decolourised by Hydrosulphite X, the colour not returning in air but restored by persulphate: Triphenylmethane group. | |
| | | The colour is completely or largely stripped, giving a coloured acid extract, which is precipitated by Tannin solution: Basic dyestuff (on tannin or other mordant) or Basic Mordant dyestuff. Boil with Saline caustic soda, rinse well and boil with white wool and plain water. | |
| | | The colour is not stripped or the | |
| | | Decolourised. Colour returns on exposure to air: Azine, Oxazine, or Thiazine group. | |
| | | Colour becomes red just before being decolourised. Colour returns to violet or green on exposure to air: Safranine Azo group. | |
| | | Decolourised. Colour does not return on exposure to air, but is restored by persulphate: Triphenylmethane group. | |
| | | The wool is not dyed. Cr in ash. Cotton decolourised by Hydrosulphite X, the colour not returning in air but restored by persulphate: Triphenylmethane group. | |
| | | Cr and Cu absent: Azo Salt dyestuff. | |
| | | Cr or Cu present: Azo Salt dyestuff after-treated. | |
| | | Colour destroyed. Fe is present in the ash: Nitroso group. | |
| | | Not decolourised. Cr is present in the ash: Mordant Azo dyestuff. | |
| 1. | Acid greens, Naphtalene Green. | | |
| 2. | Fast Green M, Methylene Green, Azine green, Capii green, &c. | | |
| 3. | Janus Green, Diazine Green, &c. | | |
| 4. | Brilliant Green, Malachite Green, Methyl Green, Victoria Green, Setoglucine, &c. | | |
| 5. | Chrome Green. | | |
| 6. | Diamine Green, Benzo Green, Columbia Green, Chloramine Green, &c. | | |
| 7. | The preceding Coppered or Chromed. | | |
| 8. | Solid Green, Nitroso Green, Russian Green, Fast green O, Steam Green, Alsace Green, Gambines, Dioxime &c. | | |
| 9. | Diamond Green, &c. | | |

1. Greens of the nitroso group (Gambines, &c.) may become black on reduction

Green Colours.

ammonia (1:100).

Saline caustic soda, rinse and boil twice with weak formic acid.

acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X

| | | | | |
|--|---|--|---|--|
| The colour is changed to greenish yellow, not restored to green by air, which can be decolourised and developed red with beta-naphthol. Primuline Azo group. | Decolourised. Colour returns on exposure to air: Azine, Oxazine, or Thiazine group. Apply lead acetate test | | The colour is unaffected or changed to red, brown, blue, &c. Test ash for Cr and Ni. | |
| | H ₂ S is evolved; Sulphide dyestuff. | No H ₂ S is evolved; Mordant Oxazine (or Thiazine). | The ash contains Cr or Ni. Anthracene Mordant dyestuff. | |
| No Cr or Ni present in ash: Anthracene Vat dyestuff. | | | | |
| Reduced colour is brownish red Green restored by persulphate but not by air. Boiling HCl (1:20) gives bright green solution. | Reduced colour is brown. Green shade returns on exposure to air. Boil with hydrochloric acid (1:20). | | Reduced colour is brownish olive. H ₂ S evolved on applying lead acetate test. | |
| | Colour unaffected. Solution colourless. Cr in ash | Reduced colour is dark maroon. Green shade restored by air. | | |
| | Colour of fibre becomes grey, solution red. Ni in ash | Reduced colour is blue. Green shade restored by air | | |
| | Colour of fibre rather paler, solution brownish yellow. | | | |
| Reduced to yellow, which is restored by air oxidation: Indigo dyestuff. | | | | |

| | |
|-----|---|
| 10. | Primuline Developed with Amidodiphenylamine. |
| 11. | Greens of the Immedial, Kaigene, Throgene, Pyrogene, Sulphur, and Thionol series |
| 12. | Gallanilic Green, Indalazarine, &c. |
| 13. | Alizarine Viridine, Brilliant Alizarine Viridine. |
| 14. | Alizarine Green S on Cr mordant. |
| 15. | Alizarine Green S on Ni, Mg mordant. |
| 16. | Ceruleine, Anthracene green. |
| 17. | Indanthrene Olive or Olrvanthrene. |
| 18. | Indanthrene Green or Viridanthrene. Leucol Dark Green B. |
| 19. | Algol Green, Indanthrene Blue in admixture with Indanthrene Yellow or with Anthraflavone. |
| 20. | Ciba Green. |

if the Hydrosulphite X is insufficiently acid (formation of Fe S).

Table VI.

| | | Boil with Weak | | | |
|----|--|--|---|---------------|--|
| | | The colour is not stripped. Boil for half minute with Saline | | | |
| | | The colour is not stripped or the acid extract is | | | |
| | The colour is stripped: Acid dyestuff. Transferred to wool it is permanently decolourised by Hydrosulphite A: Azo group. | The colour is stripped giving acid extract which is precipitated by Tannin solution: Basic dyestuff. The dyestuff transferred to wool is permanently decolourised by Hydrosulphite A: Azo group. | Decolourised and colour not restored on exposure to air or by persulphate Azo group and Mineral Colours. Boil with soap solution and white mercerised cotton. | | |
| | | | The white cotton is stained: Salt dyestuff Test ash for Cr and Cu. | | |
| | | | The white cotton is not stained. Boil with pyridine. | | |
| | | | The colour is stripped: Insoluble Azo Colour. Test Ash for Cu. | | |
| | | The colour is not stripped. Mineral Colour. Treat with sodium bisulphite in the cold. | | | |
| | | Ci and Cu absent Azo Salt dyestuff | Ci or Cu present: Azo Salt dyestuff after treated | | |
| 1. | Fast Brown, Naphthylamine Brown, Acid Brown, &c. | | Cu absent. | Cu present. | |
| 2. | Vesuvine, Bismarck Brown, Janus Brown, Chrysoidine. | | | Decolourised. | |
| 3. | Browns of the Diamine, Benzo, Congo, Dianil Columbia, Hessian, Oxamine and Toluylene Series. | | | | |
| 4. | The preceding Coppered or Chromed. | | | | |
| 5. | Para Brown (Chrysoidine and Patanitriline), Benzidine or Tolidine Brown. | | | | |
| 6. | Para red Coppered. | | | | |
| 7. | Manganese Bistrie | | | | |
| 8. | Iron Buff, Khaki (Oxides of Cr and Fe). | | | | |

1. Iron Buff and Khaki may become black on reduction if the Hydrosulphite

Brown Colours.

ammonia (1.100).

caustic soda, rinse, and boil twice with weak formic acid (1.100).

not precipitated by Tannin solution. Reduce with Hydrosulphite X.

| | | | | | | | |
|---|-----|--|---|--|---|---|--|
| Primuline developed with Meta-phenylene Diamine, Terra-Cotta, &c. | 9. | The shade is changed to greenish yellow which can be diazotised and developed red with betanaphthol: Primuline A/o Colour. | Decolourised and original colour restored by air: Indigo group. | Unaltered or changed in shade, becoming darker, paler, yellower, &c. Apply lead acetate test | No H ₂ S is evolved. Test ash for Cr and Cu. | Cr or Cu (or both) present: Mordant dyestuff. Boil with HCl (1:20). | Cr and Cu absent: Anthracene Vat dyestuff, &c. |
| Helindone Brown G. | 10. | | | | | | |
| Immedial Cutch, Cross Dye Brown, Katigene Browns, Pyrogene Browns, Thiogene Browns, &c. | 11. | | | | | | |
| Alizarine Brown, Anthragallol, Anthracene Brown. | 12. | | | | | | |
| Alizarine Orange on Cr Mordant, Alizarine or Purpurine on Cu. | 13. | | | | | | |
| Cutch. | 14. | | | | | | |
| Indanthrene Maroon, Algaole Brown, Leucole Browns, Cibacnone Brown, Paramine Brown (p-Phenylene Diamine oxidised on fibre). | 15. | | | | | | |

is insufficiently acid (formation of Fe S).

Table VII.

| | | Boil with Weak | | | |
|---|--------------------------------|---------------------------------------|---|--|---|
| | | The colour is not stripped. Boil with | | | |
| The colour is stripped. Acid dyestuff. The dyestuff transferred to wool and boiled with Hydrosulphite A is permanently decolourised: Azo group. | The colour is stripped. | | The colour is not stripped (or only slightly). Boil for | | |
| | Fibre and solution colourless. | Solution orange. Fe in ash. | The colour is largely stipped and the acid extract is precipitated by Tannin solution: Basic dyestuff. Transfer to wool (see note) and boil with Hydrosulphite A. | The colour Reduced | |
| | | | | Decolourised by air or group and white | |
| | | | | The white stained Cr and | |
| 1. Carbon Black, Amido-Naphthol Blacks, Naphthylamine Blacks, Palatine Black, &c. | 2. Tannate of Iron. | 3. Logwood Black on Iron mordant. | 4. Logwood Black on Chrome mordant, Noir Reduit. | 5. Methylene Grey, New Methylene Grey, New Fast Grey, Nigrosine, &c. | 6. Janus Black, Janus Grey, Diazine Grey. |
| | | | | | 7. Blacks of the Diamine, Oxydiamine, Benzo, Columba, Dianil, Pluto, &c., series. Also Diaminogen, Diazo Blacks, &c (developed or coupled). |

1. Chrome Black (By) becomes light brown on reduction with Hydrosulphite and persulphates, change the colour to dark brown but not to black.

Black and Grey Colours.

ammonia (1:100).

Dilute hydrochloric acid (1:5).

one minute with Saline caustic soda, rinse, and boil with Dilute hydrochloric acid (1:20).

is not stripped or acid extract is not precipitated by Tannin solution.
with Hydrosulphite X.

and colour not restored
persulphate. Azo
Boil with soap solution
mercerised cotton.

cotton is
Test ash for
Cu.

The white cotton is not stained.
Colour is stripped by boiling
pyridine:
Insoluble Azo colour.

Decolourised and colour restored by air. Gives
violet vapours on heating in dry tube:
Indigoid dyestuff.

The colour is unaffected or changed in shade
(becoming brown, maroon, &c.

The reduced colour is
brown but is rapidly re-
stored to black on exposure
to air: Azine, Oxazine,
or Thiazine group.
Apply lead acetate test.

Only slowly
restored to black by air
but at once by persulphate. Cr present in
ash: Naphthalene Mordant dyestuff.

Colour not
changed by re-
duction (or very
slightly:
Anthracene
group. Test ash
for Cr.

Cr present: Anthra-
cene Mordant
dyestuff.

Cr absent: Anthra-
cene Vat
dyestuff.

| | | |
|---|--|---|
| Cr or Cu present: Azo Salt dyestuff after- treated. | Cr present: Anthracene Mordant dyestuff. | Cr absent: Anthracene Vat dyestuff. |
| 8. The preceding Coppered or Chromed. | 9. Azophor Black, &c. | 10. Ciba Grey G and B. |
| 11. Blacks of the Immedial, Katigene, Gross dye, Pyrogene, Thiogene, Thionol, Pyrol, Sulphur, &c., Series. | 12. Aniline Black, Diphenyl Black | 13. Naphthazarine S, Alizarine Black S [B], Alizarine Blue Black SW, Naphthomelane. |
| 14. Alizarine Cyanine Black, Aliza- rine Blue Black B. | 15. Indanthrene Grey or Melanthrene. | |

2. Aliz. Black S [M] returns rapidly after reduction and gives the sulphide reaction
with SnCl_2 . It, therefore, appears to fall into Group 10.

III. CHEMICALS.

1. Table of some Atomic Weights.

O = 16

(According to the German Chemical Society).

| | | | | | |
|--------------|----|--------|--------------|----|--------|
| Aluminium . | Al | 27,1 | Magnesium | Mg | 24,36 |
| Antimony . | Sb | 120 | Manganese | Mn | 55 |
| Arsenic . . | As | 75 | Mercury . | Hg | 203 |
| Barium . . | Ba | 137,4 | Molybdenum | Mo | 96 |
| Bismuth . . | Bi | 208,5 | Nickel . . | Ni | 58,7 |
| Boron . . . | B | 11 | Nitrogen . | N | 14,04 |
| Bromine . . | Br | 79,96 | Oxygen . . | O | 16 |
| Cadmium . . | Cd | 112,4 | Phosphorus | P | 31 |
| Calcium . . | Ca | 40 | Platinum . | Pt | 194,8 |
| Carbon . . . | C | 12 | Potassium . | K | 39,15 |
| Cerium . . . | Ce | 140 | Silicium . . | Si | 28,4 |
| Chlorine . . | Cl | 35,5 | Silver . . . | Ag | 107,93 |
| Chromium . . | Cr | 52,1 | Sodium . . | Na | 23,05 |
| Cobalt . . . | Co | 59 | Strontium . | Sr | 87,6 |
| Copper . . . | Cu | 63,6 | Sulphur . . | S | 32,06 |
| Fluorine . . | F | 19 | Tin | Sn | 118,5 |
| Gold | Au | 197,2 | Titanium . | Ti | 48 |
| Hydrogen . . | H | 1,01 | Tungsten . | W | 184 |
| Iodine . . . | I | 126,85 | Uranium . . | U | 239,5 |
| Iron | Fe | 56 | Vanadium . | V | 51,2 |
| Lead | Pb | 206,9 | Zinc | Zn | 65,4 |

2. Table of Molecular weights
of chemicals used in dyeing.

| Name | Formula | Mol. Weight |
|----------------------------|--|-------------|
| Acetate of Alumina | $Al_2(C_2H_3O_2)_3$ | 408 |
| Acetate of Ammonia | $NH_4C_2H_3O_2$ | 77 |
| Acetate of Chrome (basic) | $Cr_2(C_2H_3O_2)_4 \cdot (OH)_2$ | 374 |
| Acetate of Chrome (normal) | $Cr_2(C_2H_3O_2)_6$ | 458 |
| Acetate of Lime | $Ca(C_2H_3O_2)_2$ | 158 |
| Acetate of Nickel | $(C_2H_3O_2)_2 Ni$ | 177 |
| Acetate of Soda | $Na(C_2H_3O_2) + 3 H_2O$ | 136 |
| Acetate of Tin | $Sn(C_2H_3O_2)_2$ | 237 |
| Acetic Acid | CH_3COOH | 60 |
| Acetine | $C_3H_4(C_2H_3O_2)_2$ | 218 |
| Acid Sodium Sulphate | $NaHSO_4$ | 120.12 |
| Acid Sodium Sulphite | $NaHSO_3$ | 104 |
| Alcohol | C_2H_5OH | 46 |
| Alpha Naphtylamine | $C_{10}H_7NH_2$ | 143 |
| Alum (Potash) | $Al_2(SO_4)_3 \cdot K_2SO_4 + 24 H_2O$ | 949 |
| Aluminium Chloride | Al_2Cl_6 | 267 |
| Aluminium Sulpho Acetate | $Al_2SO_4(C_2H_3O_2)_4$ | 386 |
| Ammonia | NH_3 | 17 |
| Ammonium Chloride | NH_4Cl | 54 |
| Ammonium Tin Chloride | $SnCl_4 + 4 NH_4Cl$ | 367 |
| Ammonium Vanadate | $(NH_4)_2VO_4$ | 169 |
| Aniline | $C_6H_5NH_2$ | 93 |
| Aniline Salt | $C_6H_5NH_2 \cdot HCl$ | 130 |
| Antimony Fluoride | SbF_3 | 177 |
| Antimony Oxide | Sb_2O_3 | 288 |
| Antimony Salt | $SbF_3 \cdot (NH_4)_2SO_4$ | 309 |
| Antimony Sodium Fluoride | $SbF_3 \cdot NaF$ | 219 |
| Barium Chloride | $BaCl_2 + 2 H_2O$ | 244 |
| Benzene | C_6H_6 | 78 |
| Beta Naphtol | $C_{10}H_7OH$ | 144 |
| Bichromate of Soda | $Na_2Cr_2O_7 + 2 H_2O$ | 298 |
| Bichromate of Potash | $K_2Cr_2O_7$ | 295 |
| Bisulphite of Chrome | $Cr_2(HSO_3)_6$ | 591 |
| Borax | $Na_2B_4O_7 + 10 H_2O$ | 382 |
| Calcium Chloride | $CaCl_2$ | 111 |
| Caustic Lime | CaO | 56 |
| Caustic Soda | $NaOH$ | 40 |
| Caustic Potash | KOH | 56 |
| Cerochloride | $CeCl_3$ | 246 |
| Chalk | $CaCO_3$ | 100 |
| Chlorate of Alumina | $Al_2(ClO_3)_6$ | 555 |
| Chloride of Chrome (basic) | $Cr_2Cl_3(OH)_4$ | 243 |
| Chlorate of Potassium | $KClO_3$ | 123 |

| Name | Formula | Mol. Weight |
|---------------------------|---|-------------|
| Chlorate of Sodium | NaClO_3 | 107 |
| Chromate of Chrome | $\text{Cr}_2(\text{CrO}_4)_3$ | 453 |
| Chromate of Lead | PbCrO_4 | 323 |
| Chrome Alum | $\text{Cr}_2(\text{SO}_4)_3 \cdot \text{K}_2\text{SO}_4 + 24\text{H}_2\text{O}$ | 999 |
| Chrome Oxide | Cr_2O_3 | 152 |
| Chromium Nitro-Acetate | $\text{Cr}_2(\text{NO}_3)_3(\text{C}_2\text{H}_3\text{O}_2)_3$ | 467 |
| Citric Acid | $\text{C}_3\text{H}_4\text{O}_7(\text{COOH})_3 + \text{H}_2\text{O}$ | 210 |
| Common Salt | NaCl | 59 |
| Cupric Chloride | $\text{CuCl}_2 + 2\text{H}_2\text{O}$ | 171 |
| Double Chloride of Tin | $\text{SnCl}_4 + 3\text{H}_2\text{O}$ | 314 |
| Formaldehyde | CO H_2 | 30 |
| Ferric Acetate | $\text{Fe}_2(\text{C}_2\text{H}_3\text{O}_2)_6$ | 466 |
| Ferric Chloride | Fe_2Cl_6 | 325 |
| Ferrous Acetate | $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_2$ | 174 |
| Ferrous Chloride | Fe_2Cl_6 | 127 |
| Ferrous Sulphate | $\text{FeSO}_4 + 7\text{H}_2\text{O}$ | 278 |
| Fluoride of Chrome | $\text{Cr}_2\text{F}_6 + 8\text{H}_2\text{O}$ | 362 |
| Formic Acid | $\text{C}_10\text{H}_7\text{OH}$ | 46 |
| *Glauber's Salt | $\text{Na}_2\text{SO}_4 + 10\text{H}_2\text{O}$ | 322 |
| Glycerine | $\text{C}_3\text{H}_5(\text{OH})_3$ | 92 |
| Hydrate of Alumina | $\text{Al}_2\text{O}_3\text{H}_6$ | 541 |
| Hydrochloric Acid | HCl | 36 |
| Hydrofluoric Acid | HF | 20 |
| Hyposulphite of Soda | $\text{Na}_2\text{S}_2\text{O}_3 + 5\text{H}_2\text{O}$ | 248 |
| Lactic Acid | $\text{C}_3\text{H}_5\text{O}_2$ | 90 |
| Magnesium Chloride | $\text{MgCl}_2 + 6\text{H}_2\text{O}$ | 203 |
| Manganous Chloride | $\text{MnCl}_2 + 4\text{H}_2\text{O}$ | 198 |
| Nitrate of Chrome | $\text{Cr}_2(\text{NO}_3)_6$ | 476 |
| Nitrate of Lead | $\text{Pb}(\text{NO}_3)_2$ | 331 |
| Nitric Acid | HNO_3 | 63 |
| Oxalate of Ammonia | $(\text{NH}_4)_2\text{C}_2\text{O}_4 + \text{H}_2\text{O}$ | 142 |
| Oxalate of Antimony | $\text{Sb}(\text{C}_2\text{O}_4\text{K})_3 + 6\text{H}_2\text{O}$ | 610 |
| Oxalic Acid | $\text{C}_2\text{O}_4\text{H}_2 + 2\text{H}_2\text{O}$ | 126 |
| Oxide of Lead | PbO | 223 |
| Paranitraniline | $\text{C}_6\text{H}_4 < \begin{matrix} \text{NO}_2 \text{ (i)} \\ \text{NH}_2 \text{ (s)} \end{matrix}$ | 138 |
| Permanganate of Potassium | KMnO_4 | 158 |
| Peroxide of Hydrogen | H_2O_2 | 34 |
| Phenol | $\text{C}_6\text{H}_5\text{OH}$ | 94 |

| Name | Formula | Mol. Weight |
|-----------------------------|---|-------------|
| ~Pink Salt | $\text{SnCl}_4 + 2\text{NH}_4\text{Cl}$ | 367 |
| Phosphate of Soda | $\text{Na}_2\text{HPO}_4 + 12\text{H}_2\text{O}$ | 358 |
| ~Potash | $\text{K}_2\text{CO}_3 + 2\text{H}_2\text{O}$ | 174 |
| Potassium Oxalate | $\text{KH}(\text{COO})_2$ | 128 |
| Potassium Hydrogen Oxalate | $\text{KH}(\text{COO})_2$ | 128 |
| Red Prussiate | $\text{K}_3\text{Fe}_2(\text{CN})_{12}$ | 659 |
| Resorcine | $\text{C}_6\text{H}_4(\text{OH})_2$ | 110 |
| Silicate of Soda | $\text{Na}_2\text{Si}_2\text{O}_5$ | 304 |
| Sugar of Lead | $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 + 3\text{H}_2\text{O}$ | 379 |
| Sulphate of Alumina | $\text{Al}_2(\text{SO}_4)_3 + 18\text{H}_2\text{O}$ | 667 |
| Sulphate of Cadmium | $\text{CdSO}_4 + 2,6\text{H}_2\text{O}$ | 256 |
| Sulphate of Copper | $\text{CuSO}_4 + 5\text{H}_2\text{O}$ | 250 |
| Sulphate of Lead | PbSO_4 | 302 |
| Sulphate of Magnesia | $\text{MgSO}_4 + 7\text{H}_2\text{O}$ | 247 |
| Sulphate of Nickel | $\text{NiSO}_4 + 7\text{H}_2\text{O}$ | 281 |
| Sulphate of Zinc | $\text{ZnSO}_4 + 7\text{H}_2\text{O}$ | 288 |
| Sulphocyanide of Ammonia | NH_4SCN | 76 |
| Sulphocyanide of Copper | $\text{Cu}(\text{SCN})_2$ | 180 |
| Sulphocyanide of Iron | $\text{Fe}(\text{SCN})_2$ | 172 |
| Sulphocyanide of Potassium | $\text{K}(\text{SCN})$ | 97 |
| Sulphuric Acid | H_2SO_4 | 98 |
| Sulphurous Acid | SO_2 | 64 |
| Soda calc. | Na_2CO_3 | 106 |
| Soda cryst. | $\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}$ | 286 |
| Sodium Aluminate | $\text{Al}_2\text{O}_3\text{N}_{46}$ | 164 |
| Sodium Bisulphite | NaHSO_3 | 104 |
| Sodium Hydrosulphite cryst. | $\text{Na}_2\text{S}_2\text{O}_4 + 2\text{H}_2\text{O}$ | 194 |
| Sodium Nitrite | NaNO_2 | 69 |
| Sodium Peroxide | Na_2O_2 | 78 |
| Sodium Sulphide | $\text{Na}_2\text{S} + 9\text{H}_2\text{O}$ | 240 |
| Stannate of Soda | Na_2SnO_3 | 213 |
| Stannic Hydrate | $\text{SnO}(\text{OH})_2$ | 169 |
| Stannous Hydrate | $\text{Sn}(\text{OH})_2$ | 153 |
| Tannin | $\text{C}_{14}\text{H}_{10}\text{O}_9$ | 322 |
| Tartar | $\text{C}_4\text{O}_6\text{KH}_5$ | 188 |
| Tartar Emetic | $\text{K}(\text{SbOC}_4\text{O}_6\text{H}_4 + \frac{1}{2}\text{H}_2\text{O})$ | 332 |
| Tartar Substitute | NaHSO_4 | 120 |
| Tartaric Acid | $\text{C}_4\text{H}_2(\text{OH})_2(\text{COOH})_2$ | 150 |
| Thiosulphate | $\text{Na}_2\text{S}_2\text{O}_3 + 5\text{H}_2\text{O}$ | 248 |
| Tin Chloride | SnCl_4 | 260 |
| Tin Salt | $\text{SnCl}_2 + 2\text{H}_2\text{O}$ | 225 |
| Tungstate of Soda | $\text{Na}_2\text{WO}_4 + 2\text{H}_2\text{O}$ | 330 |
| Water | H_2O | 18 |
| Yellow Prussiate | $\text{K}_4\text{Fe}(\text{CN})_6 + 3\text{H}_2\text{O}$ | 423 |
| Zinc Chloride | ZnCl_2 | 136 |

Note. The specific gravities of solutions given in the following tables refer mostly to water of 59° F. In order to compare them to water of greatest density (40° F), it is necessary to multiply them by 0.99916.

3. Sodium Compounds.

Sodium Hydroxide or **Caustic Soda** NaOH , molecular weight 40, is a white, crystalline, brittle substance, easily soluble in water: 1 part of solid Caustic Soda dissolves in 2 parts of cold, and in $\frac{1}{2}$ part of warm water. Caustic Soda is put upon the market in lumps, or in the form of leaves, also as an aqueous solution under the name of soda-lye. Its use in the form of leaves is preferable on account of its dissolving more quickly. The quantity of Caustic Soda in soda lye is determined either by degrees of Tw. or titrometrically. Caustic Soda must, for most purposes, be free from Iron. 1 gr. mol. NaOH is contained in 90.7 cc (123.1 grs.) soda lye 71 $\frac{1}{2}$ °Tw. or in 212 cc (250.2 grs) soda lye 26°Tw.

Specific Gravity of Caustic Soda at 59° F.
(Lunge.)

| Spec. Grav. | Bé | Tw. | % NaOH | Spec. Grav. | Bé | Tw. | % NaOH | Spec. Grav. | Bé | Tw. | % NaOH |
|-------------|----|------|-----------------|-------------|----|------|-----------------|-------------|----|-------|-----------------|
| 1.007 | 1 | 1.4 | 0.61 | 1.142 | 18 | 28.4 | 12.64 | 1.320 | 35 | 64.0 | 28.83 |
| 1.014 | 2 | 2.8 | 1.20 | 1.152 | 19 | 30.4 | 13.55 | 1.332 | 36 | 66.4 | 29.93 |
| 1.022 | 3 | 4.4 | 2.00 | 1.162 | 20 | 32.4 | 14.37 | 1.345 | 37 | 69.0 | 31.22 |
| 1.029 | 4 | 5.8 | 2.71 | 1.171 | 21 | 34.2 | 15.13 | 1.357 | 38 | 71.4 | 32.47 |
| 1.036 | 5 | 7.2 | 3.35 | 1.180 | 22 | 36.0 | 15.91 | 1.370 | 39 | 74.0 | 33.69 |
| 1.045 | 6 | 7.0 | 4.00 | 1.190 | 23 | 38.0 | 16.77 | 1.383 | 40 | 76.6 | 34.96 |
| 1.052 | 7 | 10.4 | 4.64 | 1.200 | 24 | 40.0 | 17.67 | 1.397 | 41 | 79.4 | 36.25 |
| 1.060 | 8 | 12.0 | 5.29 | 1.210 | 25 | 42.0 | 18.58 | 1.410 | 42 | 82.0 | 37.47 |
| 1.067 | 9 | 13.4 | 5.87 | 1.220 | 26 | 44.0 | 19.58 | 1.424 | 43 | 84.8 | 38.80 |
| 1.075 | 10 | 15.0 | 6.55 | 1.231 | 27 | 46.2 | 20.59 | 1.438 | 44 | 87.6 | 39.99 |
| 1.083 | 11 | 16.6 | 7.31 | 1.241 | 28 | 48.2 | 21.42 | 1.453 | 45 | 90.6 | 41.41 |
| 1.091 | 12 | 18.2 | 8.00 | 1.252 | 29 | 50.4 | 22.64 | 1.468 | 46 | 93.6 | 42.83 |
| 1.100 | 13 | 20.0 | 8.68 | 1.263 | 30 | 52.6 | 23.67 | 1.483 | 47 | 96.6 | 44.38 |
| 1.108 | 14 | 21.6 | 9.42 | 1.274 | 31 | 54.8 | 24.81 | 1.498 | 48 | 99.6 | 46.15 |
| 1.116 | 15 | 23.2 | 10.06 | 1.285 | 32 | 57.0 | 25.80 | 1.514 | 49 | 102.8 | 47.60 |
| 1.125 | 16 | 25.0 | 10.97 | 1.297 | 33 | 59.4 | 26.83 | 1.530 | 50 | 106.0 | 49.02 |
| 1.134 | 17 | 26.8 | 11.84 | 1.308 | 34 | 61.6 | 27.80 | | | | |

Sodium Peroxide Na_2O_2 , molecular weight 78, is put upon the market in yellowish lumps or in powder; it must be kept well closed up, as it easily absorbs moisture and carbonic acid. It dissolves in water by giving off heat, and is a very efficacious bleaching substance.

Hydrogen Peroxide H_2O_2 , molecular weight 34, is a bleaching agent, which is put upon the market as a dilute aqueous solution. The usual strength, e. g. "10 vols" contains 3% H_2O_2 along with common salt or magnesium chloride and phosphoric acid.

Carbonate of Soda or Soda Na_2CO_3 , mol. weight 106, soluble in 14 parts of cold and in about 2 parts of hot water, is commercially sold as calcined soda, Solvay soda Na_2CO_3 , or as crystal soda $\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}$ (mol. weight 286).

Specific Gravity and Percentage of Solutions of Soda
at 59° F.

(Lunge).

| Spec. Grav. | Beaumé | Twaddell | Percentage by weight | | 1 cubic metre contains kilos | |
|----------------|--------|----------|--------------------------|--|---------------------------------|--|
| | | | Na_2CO_3 | Na_2CO_3 + $10\text{H}_2\text{O}$ | Na_2CO_3 | Na_2CO_3 + $10\text{H}_2\text{O}$ |
| 1,007 | 1 | 1,4 | 0,67 | 1,807 | 6,8 | 18,2 |
| 1,014 | 2 | 2,8 | 1,33 | 3,587 | 13,5 | 36,4 |
| 1,022 | 3 | 4,4 | 2,09 | 5,637 | 21,4 | 57,6 |
| 1,029 | 4 | 5,8 | 2,76 | 7,444 | 28,4 | 76,6 |
| 1,036 | 5 | 7,2 | 3,43 | 9,251 | 35,5 | 95,8 |
| 1,045 | 6 | 9,0 | 4,29 | 11,570 | 44,8 | 120,4 |
| 1,052 | 7 | 10,4 | 4,94 | 13,323 | 52,0 | 140,2 |
| 1,060 | 8 | 12,0 | 5,71 | 15,400 | 60,5 | 163,2 |
| 1,067 | 9 | 13,4 | 6,37 | 17,180 | 68,0 | 183,2 |
| 1,075 | 10 | 15,0 | 7,12 | 19,203 | 76,5 | 206,4 |
| 1,083 | 11 | 16,6 | 7,88 | 21,252 | 85,3 | 230,2 |
| 1,091 | 12 | 18,2 | 8,62 | 23,248 | 94,0 | 252,6 |
| 1,100 | 13 | 20,0 | 9,43 | 25,432 | 103,7 | 279,8 |
| 1,108 | 14 | 21,6 | 10,19 | 27,482 | 112,9 | 304,5 |
| 1,116 | 15 | 23,2 | 10,95 | 29,532 | 122,2 | 329,6 |
| 1,125 | 16 | 25,0 | 11,81 | 31,851 | 132,9 | 358,3 |
| 1,134 | 17 | 26,8 | 12,61 | 34,009 | 143,0 | 385,7 |
| 1,142 | 18 | 28,4 | 13,16 | 35,493 | 150,3 | 405,3 |
| 1,152 | 19 | 30,4 | 14,24 | 38,405 | 164,1 | 442,4 |

Sodium Chloride or Common Salt NaCl , mol. weight 58,5, soluble in $2\frac{1}{2}$ parts of water, forms regular crystals, and is used as an addition to the dye-baths in dyeing Direct and Thiogene colours.

Specific Gravity of Solutions of Common Salt at 59° F.
(Gerlach.)

| Spec. Grav. | Per cent NaCl | Spec. Grav. | Per cent NaCl | Spec. Grav. | Per cent NaCl |
|----------------|------------------|----------------|------------------|----------------|------------------|
| 1.00725 | 1 | 1.07335 | 10 | 1.14315 | 19 |
| 1.01450 | 2 | 1.08097 | 11 | 1.15107 | 20 |
| 1.02174 | 3 | 1.08859 | 12 | 1.15931 | 21 |
| 1.02899 | 4 | 1.09622 | 13 | 1.16755 | 22 |
| 1.03624 | 5 | 1.10384 | 14 | 1.17580 | 23 |
| 1.04366 | 6 | 1.11146 | 15 | 1.18404 | 24 |
| 1.05108 | 7 | 1.11938 | 16 | 1.19228 | 25 |
| 1.05851 | 8 | 1.12730 | 17 | 1.20098 | 26 |
| 1.06593 | 9 | 1.13523 | 18 | 1.20433 | 26.395 |

Sodium Hypochlorite, NaOCl , mol. weight 74.5, is used for bleaching and can be added direct to soap solutions. It is particularly efficient in cleansing goods dyed with ice colours.

Sodium Hypochlorite is produced either by electrolysis of common salt by means of so-called electrolisers, or by chemical reaction of soda upon chloride of lime:

1. 100 lbs. Chloride of Lime 36% are carefully ground with 45 gall. Water,
2. 60 lbs. Solvay Soda (98%) are dissolved in $22\frac{1}{2}$ gall. Boiling Water, and diluted with so much water that, on being slowly entered into the chloride of lime solution, there will then be a
100 galls of liquid.

The solution is stirred for $\frac{1}{2}$ hour and allowed to stand overnight. This yields 65 gall. clear solution of Sodium Hypochlorite 11° Tw.

Sodium Chlorate, NaClO_3 , mol weight 106.5 (soluble in 1 part cold and $\frac{1}{2}$ part of hot water) is put upon the market in crystals, and is preferred to the corresponding Potassium salt on account of its greater solubility. It is extensively used as an oxidising medium in Aniline Black and Diphenyl Black printing, and also as Chlorate discharge. Further, it is used in wool printing as an addition to certain colours, in order to prevent the reduction of the colour during steaming (Carbon Black).

Sodium Bromide Bromate is put upon the market under the name of Discharge Salt II and can be used to replace a part of the chlorate in oxidation discharges; the white obtained with it, however, has a yellow shade.

Sodium Sulphide, $\text{Na}_2\text{S} + 9\text{H}_2\text{O}$, mol. weight 240, is put upon the market in crystals. In the melted state 50 parts correspond with 100 parts of Sodium Sulphide crystals. It is very soluble, hygroscopic, and is used as a solvent of Sulphur Colours, for the preparation of Sulphide of Copper etc.

Sodium Bisulphite NaHSO_3 , mol. weight 104, forms small and easily soluble prisms, and is put upon the market as Bisulphite cryst. or in solutions of 66 $\frac{1}{2}$ ° Tw. It is used in kier boiling for Aniline Black resist, for preparing the hydrosulphite indigo vat, and for producing certain bisulphite compounds of dyestuffs, as e. g. of Alizarine Blue and Ceruleme.

Specific Gravity of Solution of Sodium Bisulphite
at 59° F.

| Spec. Grav. | De- grees Bé | Percent- age NaHSO_3 | Per- centage SO_2 | Spec. Grav. | De- grees Bé | Percent- age NaHSO_3 | Per- centage SO_2 |
|----------------|--------------------|-------------------------------------|----------------------------------|----------------|--------------------|-------------------------------------|----------------------------------|
| 1,008 | 1 | 1.6 | 0.4 | 1,171 | 21 | 16.5 | 10.2 |
| 1,022 | 3 | 2.1 | 1.3 | 1,190 | 23 | 18.5 | 11.5 |
| 1,038 | 5 | 3.6 | 2.2 | 1,210 | 25 | 20.9 | 12.9 |
| 1,052 | 7 | 5.1 | 3.1 | 1,230 | 27 | 23.5 | 14.5 |
| 1,068 | 9 | 6.5 | 3.9 | 1,252 | 29 | 25.9 | 15.9 |
| 1,084 | 11 | 8.0 | 4.8 | 1,275 | 31 | 28.9 | 17.8 |
| 1,100 | 13 | 9.5 | 5.7 | 1,298 | 33 | 31.7 | 19.6 |
| 1,116 | 15 | 11.2 | 6.8 | 1,321 | 35 | 34.7 | 22.5 |
| 1,134 | 17 | 12.8 | 7.8 | 1,345 | 37 | 38 | 23.6 |
| 1,152 | 19 | 14.6 | 9.0 | | | | |

Sodium Bisulphate or Tartar Substitute, NaHSO_4 , mol. weight 120, forms a white crystalline mass, which is easily soluble in water. It is used instead of Glauber's salt and Sulphuric acid for dyeing acid wool colours. 10 parts Tartar Substitute equal 4 parts Sulphuric acid and 10 parts Glauber's salt.

Sodium Sulphate, Na_2SO_4 , mol. weight 142 (soluble in 20 parts water 32° F and 2 $\frac{1}{2}$ parts boiling water), is commercially known as Glauber's salt, $\text{Na}_2\text{SO}_4 + 10\text{H}_2\text{O}$, mol. weight 322. It is chiefly used as addition to the dyebaths of the Direct and Thiogene colours, as well as an addition in the dyeing of acid wool colours in order to reduce the action of the acid and to facilitate equalising. Glauber's salt is also put upon the market as calcined Glauber's salt, which is free from water.

Specific Gravity of Solutions of Glauber's Salt at 66° F.
(Schiff)

| Spec. Grav. | Per cent Na ₂ SO ₄ + 10 aq. | Per cent Na ₂ SO ₄ | Spec. Grav. | Per cent Na ₂ SO ₄ + 10 aq. | Per cent Na ₂ SO ₄ | Spec. Grav. | Per cent Na ₂ SO ₄ + 10 aq. | Per cent Na ₂ SO ₄ |
|-------------|---|--|-------------|---|--|-------------|---|--|
| 1.0040 | 1 | 0.441 | 1.0439 | 11 | 4.851 | 1.0849 | 21 | 9.261 |
| 1.0079 | 2 | 0.881 | 1.0479 | 12 | 5.292 | 1.0890 | 22 | 9.702 |
| 1.0118 | 3 | 1.323 | 1.0520 | 13 | 5.733 | 1.0931 | 23 | 10.143 |
| 1.0158 | 4 | 1.764 | 1.0560 | 14 | 6.174 | 1.0973 | 24 | 10.584 |
| 1.0198 | 5 | 2.205 | 1.0601 | 15 | 6.615 | 1.1015 | 25 | 11.025 |
| 1.0238 | 6 | 2.646 | 1.0642 | 16 | 7.056 | 1.1057 | 26 | 11.466 |
| 1.0278 | 7 | 3.087 | 1.0683 | 17 | 7.497 | 1.1100 | 27 | 11.907 |
| 1.0318 | 8 | 3.528 | 1.0725 | 18 | 7.938 | 1.1142 | 28 | 12.348 |
| 1.0358 | 9 | 3.969 | 1.0766 | 19 | 8.379 | 1.1184 | 29 | 12.789 |
| | 10 | 4.410 | 1.0807 | 20 | 8.820 | 1.1226 | 30 | 13.230 |

Sodium Thiosulphate, Sodium Hyposulphite, Antichlor, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$. 100 parts of this product are soluble in 102 parts cold water. It forms colourless crystals, and in the presence of Hydrochloric or Sulphuric acid is decomposed, sulphur dioxide being evolved and sulphur separated out. It serves, amongst other purposes, for the production of a sulphur mordant for Brilliant and Malachite Green.

Sodium Nitrite NaNO_2 , mol. weight 69, is put upon the market in crystals, and is easily soluble. It is used in diazotising ice colours.

Sodium Phosphate. The common Sodium Phosphate $\text{Na}_2\text{HPO}_4 + 12\text{H}_2\text{O}$, mol. weight 358, (soluble in 35 parts of cold and 1 part hot water) forms crystals which readily decompose and crumble away. It is used in dyeing and printing with Direct colours for fixing alumina mordants upon Alizarine Red, and for diazotising without ice.

Sodium Pyrophosphate $\text{Na}_4\text{P}_2\text{O}_7 + 10\text{H}_2\text{O}$, mol. weight 446, soluble in 20 parts of cold and 1 part of hot water) forms white crystals and is used in discharging Alpha Naphtylamine Claret with Hydrosulphite.

Sodium Borate or Borax, $\text{Na}_2\text{B}_4\text{O}_7 + 10\text{H}_2\text{O}$, mol. weight 382, (soluble in 15 parts of cold and $\frac{1}{2}$ part of hot water), forms large monoclinic prisms, and owing to its slightly alkaline character, serves as a solvent for the Alizarine dyestuffs in padding.

Sodium Silicate or Waterglass, $\text{Na}_2\text{Si}_2\text{O}_5$, mol. weight 302, is put upon the market as a thick liquid of 66½-77° Tw. or in the solid state, and is used for "dunting", also as an addition to white discharges on Turkey red, and for the alkali boiling process in bleaching cotton fabrics.

Sodium Arseniate, $\text{Na}_2\text{HASO}_4 + 12\text{H}_2\text{O}$, mol. weight 402. (soluble in 3 parts of cold water and easily soluble in hot water) is used as an addition to the "dyeing" bath for the treatment of goods prepared with Aluminium or Iron mordants. It is poisonous, and if possible, should be replaced by Sodium Phosphate.

Sodium Acetate, $\text{NaC}_2\text{H}_3\text{O}_2 + 3\text{H}_2\text{O}$, mol. weight 136 (soluble in 3 parts cold and in $\frac{1}{2}$ part hot water) is used as an addition to the Diazo solutions in printing and dyeing with ice colours, and for neutralising mineral acid; moreover, as an addition to tin salt discharges, and also for rinsing goods dyed with Sulphur colours.

Specific Gravity of Solutions of Sodium Acetate
at $63\frac{1}{2}^{\circ}\text{Tw}$.
(Gerlach.)

| Specific Gravity | Per cent $\text{NaC}_2\text{H}_3\text{O}_2$ | Per cent $\text{NaC}_2\text{H}_3\text{O}_2 + 3\text{H}_2\text{O}$ |
|------------------|--|--|
| 1,015 | 3,015 | 5 |
| 1,031 | 6,030 | 10 |
| 1,047 | 9,045 | 15 |
| 1,063 | 12,060 | 20 |
| 1,0795 | 15,075 | 25 |
| 1,0960 | 18,090 | 30 |
| 1,1130 | 21,105 | 35 |
| 1,1305 | 24,120 | 40 |
| 1,1485 | 27,135 | 45 |
| 1,1670 | 30,150 | 50 |

Sodium Tartrate, $\text{C}_4\text{H}_4\text{O}_6\text{Na}_2$, mol. weight 194 is produced by neutralising Tartaric acid with Caustic soda, and is used as an addition to oxidation discharges.

Sodium Citrate, $\text{C}_6\text{H}_5(\text{OH})(\text{COONa})_2$, mol. weight 258, is produced by neutralising Citric acid with Caustic soda. It is used as a solution of $52\frac{1}{2}^{\circ}\text{Tw}$, which should give the acid reaction for resisting Alizarine steam colours, for discharging chrome mordants and as an addition to oxidation discharges etc.

4. Potassium Compounds.

Potassium Hydroxide or Caustic Potash, KOH , mol. weight 56, forms a white crystalline substance, and is sometimes preferred to Caustic soda in Indigo printing, owing to its better solubility.

Potassium Carbonate or Potash $K_2CO_3 + 2H_2O$, mol. weight 174, is easily soluble in water, and forms a white hygroscopic substance.

In dyeing, crude Potash is used instead of Soda when setting fermentation vats. Further it is employed for the production of soaps (Potash soaps) and in wool washing, it has a milder alkaline action than Soda.

Specific Gravity of Caustic Potash at 59° F.
(Lunge)

| Spec. Grav. | Bé | Per cent K_2CO_3 | Spec. Grav. | Bé | Per cent K_2CO_3 | Spec. Grav. | Bé | Per cent K_2CO_3 |
|-------------|----|--------------------|-------------|----|--------------------|-------------|----|--------------------|
| 1,007 | 1 | 0,7 | 1,152 | 19 | 16,0 | 1,332 | 36 | 32,7 |
| 1,014 | 2 | 1,5 | 1,162 | 20 | 17,0 | 1,345 | 37 | 33,8 |
| 1,022 | 3 | 2,3 | 1,172 | 21 | 18,0 | 1,357 | 38 | 34,8 |
| 1,029 | 4 | 3,1 | 1,180 | 22 | 18,8 | 1,370 | 39 | 35,9 |
| 1,037 | 5 | 4,0 | 1,190 | 23 | 19,7 | 1,383 | 40 | 37,0 |
| 1,045 | 6 | 4,9 | 1,200 | 24 | 20,7 | 1,397 | 41 | 38,2 |
| 1,052 | 7 | 5,7 | 1,210 | 25 | 21,6 | 1,410 | 42 | 39,3 |
| 1,060 | 8 | 6,5 | 1,220 | 26 | 22,5 | 1,424 | 43 | 40,5 |
| 1,067 | 9 | 7,3 | 1,231 | 27 | 23,5 | 1,438 | 44 | 41,7 |
| 1,075 | 10 | 8,1 | 1,241 | 28 | 24,5 | 1,453 | 45 | 42,8 |
| 1,083 | 11 | 9,0 | 1,252 | 29 | 25,5 | 1,468 | 46 | 44,0 |
| 1,091 | 12 | 9,8 | 1,263 | 30 | 26,6 | 1,483 | 47 | 45,2 |
| 1,100 | 13 | 10,7 | 1,274 | 31 | 27,5 | 1,498 | 48 | 46,5 |
| 1,108 | 14 | 11,6 | 1,285 | 32 | 28,5 | 1,514 | 49 | 47,7 |
| 1,116 | 15 | 12,4 | 1,297 | 33 | 29,6 | 1,530 | 50 | 48,9 |
| 1,125 | 16 | 13,3 | 1,308 | 34 | 30,7 | 1,547 | 51 | 50,1 |
| 1,134 | 17 | 14,2 | 1,320 | 35 | 31,6 | 1,563 | 52 | 51,3 |
| 1,142 | 18 | 15,0 | | | | | | |

Potassium Chlorate, $KClO_3$, mol. weight 122.5 (soluble in 14 parts of cold and in 2 parts of hot water), forms transparent monoclinic tablets, and is used as an oxidising agent

Potassium Sulphite, $K_2SO_3 + H_2O$, mol. weight 194, is put upon the market as a solution of 91° Tw. and is used in printing sulphite discharges and resists. In solid form it is sensitive to the air, and must therefore be stored in closed vessels.

Potassium Persulphate, $K_2S_2O_8$, mol. weight 270, is a strong oxidising agent. It is not readily soluble in water and is therefore often replaced by ammonium salt, which is much more soluble. It is used in the production of the blue-red styles by means of Dianisidine Blue on Para Red.

Potassium Pyrosulphite or Potassium Metasulphite, $K_2S_2O_5$, mol. weight 222, is a stable preparation of sulphite in the form of powder, which is used for dyeing Turkey Red by a simplified method.

5. Ammonium Compounds.

Ammonia or Spirits of Ammonia, NH_3 , mol. weight 17, is usually put upon the market as a solution of 25%. It is a volatile base, and is used for the most varied purposes in dyeing and printing.

Specific Gravity of Solutions of Ammonia at 59°F.

referred to Water of 59°F. = I.

(Lunge und Wiernik.)

| Spec. Grav. | Per cent NH_3 . | 1 litre contains grs. NH_3 at 59°F | Cor-rection for $+1\frac{1}{2}^\circ\text{F}$. | Spec. Grav. | Per cent NH_3 . | 1 litre contains grs. NH_3 at 59°F | Cor-rection for $+1\frac{1}{2}^\circ\text{F}$ |
|-------------|--------------------------|---|---|-------------|--------------------------|---|---|
| 1,000 | 0,00 | 0,0 | 0,00018 | 0,940 | 15,63 | 146,0 | 0,00039 |
| 0,998 | 0,45 | 4,5 | 0,00018 | 0,938 | 16,22 | 152,1 | 0,00040 |
| 0,996 | 0,91 | 9,1 | 0,00019 | 0,936 | 16,82 | 157,4 | 0,00041 |
| 0,994 | 1,37 | 13,6 | 0,00019 | 0,934 | 17,42 | 162,7 | 0,00041 |
| 0,992 | 1,84 | 18,2 | 0,00020 | 0,932 | 18,03 | 168,1 | 0,00042 |
| 0,990 | 2,31 | 22,9 | 0,00020 | 0,930 | 18,64 | 173,4 | 0,00042 |
| 0,988 | 2,80 | 27,7 | 0,00021 | 0,928 | 19,25 | 178,6 | 0,00043 |
| 0,986 | 3,30 | 32,5 | 0,00021 | 0,926 | 19,87 | 184,2 | 0,00044 |
| 0,984 | 3,80 | 37,4 | 0,00022 | 0,924 | 20,49 | 189,3 | 0,00045 |
| 0,982 | 4,30 | 42,2 | 0,00022 | 0,922 | 21,12 | 194,7 | 0,00046 |
| 0,980 | 4,80 | 47,0 | 0,00023 | 0,920 | 21,75 | 200,1 | 0,00047 |
| 0,978 | 5,30 | 51,8 | 0,00023 | 0,918 | 22,39 | 205,6 | 0,00048 |
| 0,976 | 5,80 | 56,6 | 0,00024 | 0,916 | 23,03 | 210,9 | 0,00049 |
| 0,974 | 6,30 | 61,4 | 0,00024 | 0,914 | 23,68 | 216,3 | 0,00050 |
| 0,972 | 6,80 | 66,1 | 0,00025 | 0,912 | 24,33 | 221,9 | 0,00051 |
| 0,470 | 7,31 | 70,9 | 0,00025 | 0,910 | 24,99 | 227,4 | 0,00052 |
| 0,968 | 7,82 | 75,7 | 0,00026 | 0,908 | 25,65 | 232,9 | 0,00053 |
| 0,966 | 8,33 | 80,5 | 0,00026 | 0,906 | 26,31 | 238,3 | 0,00054 |
| 0,964 | 8,84 | 85,2 | 0,00027 | 0,904 | 26,98 | 243,9 | 0,00055 |
| 0,962 | 9,35 | 89,9 | 0,00028 | 0,902 | 27,65 | 249,4 | 0,00056 |
| 0,960 | 9,91 | 95,1 | 0,00029 | 0,900 | 28,33 | 255,0 | 0,00057 |
| 0,958 | 10,47 | 100,3 | 0,00030 | 0,898 | 29,01 | 260,5 | 0,00058 |
| 0,956 | 11,03 | 105,4 | 0,00031 | 0,896 | 29,69 | 266,0 | 0,00059 |
| 0,954 | 11,60 | 110,7 | 0,00032 | 0,894 | 30,37 | 271,5 | 0,00060 |
| 0,952 | 12,17 | 115,9 | 0,00033 | 0,892 | 31,05 | 277,0 | 0,00060 |
| 0,950 | 12,74 | 121,0 | 0,00034 | 0,890 | 31,75 | 282,6 | 0,00061 |
| 0,948 | 13,31 | 126,2 | 0,00035 | 0,888 | 32,50 | 288,6 | 0,00062 |
| 0,946 | 13,88 | 131,3 | 0,00036 | 0,886 | 33,25 | 294,6 | 0,00063 |
| 0,944 | 14,46 | 136,5 | 0,00037 | 0,884 | 34,10 | 301,4 | 0,00064 |
| 0,942 | 15,04 | 141,7 | 0,00038 | 0,882 | 34,95 | 308,3 | 0,00065 |

The figures for correction in column 4 apply to the difference of temperature between 55—63°F., e. g. if, at 55°, the specific gravity is found to be 0,900, it must be put at 59° as $2 \times 0,00057 = 0,001$ less, which then gives the specific gravity as 08,99 by which the proportion of ammonia becomes $\frac{1}{3}\%$ higher.

Ammonium Carbonate, $(\text{NH}_4)_2\text{CO}_3$, mol. weight 96, is generally used in the form of Spirits of Hartshorn, which is converted into Ammonium Carbonate when dissolved in hot water. It is used in wool washing as an addition to the washing lyes and sometimes also as a neutralising agent, e. g. in hat manufacturing.

Ammonium Chloride, NH_4Cl , mol. weight 53.4, (soluble in 3 parts of cold and in $1\frac{1}{2}$ parts of hot water), is put upon the market in white crystals. The solutions of ammonium chloride in water dissociate, when heated, into volatile ammonia and hydrochloric acid. In printing, use is made of this property of acting as an acid in its gaseous state.

Ammonium Bisulphite, NH_4HSO_3 , mol. weight 99, is put upon the market in the form of a solution of 64° Tw., and is used for bisulphiting Alizarine Blue etc.

Ammonium Sulphocyanide, or NH_4SCN , mol. weight 76, forms colourless, easily soluble hygroscopic leaves. It is used as an addition to tin salt discharges, where it counteracts the hydrochloric acid formed, and thus prevents corrosion of the fibre. It may also be employed in resists under Aniline Black, and other oxidation colours. In aqueous or acid solutions it combines with copper salts, forming insoluble cyanide of copper, and is added to the dye-bath in order to protect colours which are sensitive to copper.

Ammonium Persulphate, $(\text{NH}_4)_2\text{S}_2\text{O}_8$, mol. weight 228 (soluble in $\frac{1}{2}$ part of water) forms white crystals which, in the dry state, are stable. In the moist state, it develops oxygen even at the ordinary temperature and acts as an oxidising agent. It is used in blue-red styles with Dianisidine blue on Para Red.

Ammonium Tartrate $\text{C}_4\text{H}_4\text{O}_6(\text{NH}_4)_2$, mol. weight 184, is used as an addition to certain discharges. On steaming, it splits up, and the tartaric acid acts as a discharge. Ammonium Tartrate is prepared according to the following recipe:

1000 parts Tartaric acid are dissolved in 1500 parts hot water, and slowly added at 96° F. to 1000—1200 parts of Ammonia. The solution is alkaline and is made up to 32 $\frac{1}{2}$ Tw. with water.

Ammonium Citrate, $\text{C}_6\text{H}_4(\text{OH})(\text{COONH}_4)_3$, mol. weight 243, is obtained as a solution of 86° Tw. by neutralising Citric acid with ammonia. It is used as an addition to oxidation discharges and also in resisting Alizarine colours.

Ammonium Acetate, $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$, mol. weight 78, forms deliquescent crystals, and is prepared by mixing Acetic acid and Ammonia e. g. to 105 parts of Ammonia 25% are added 150 parts Acetic acid 50%, and made up to 1000 parts. The solution thus obtained contains 100 parts Acetate of Ammonia per 1000 and reacts weakly alkaline.

On heating it is decomposed, and the solution slowly becomes more and more acid. Upon this property depends the use of Acetate of Ammonia in wool dyeing with colours which equalise with difficulty, such as certain acid, chrome developing and mordant colours.

Ammonium Oxalate, $(\text{NH}_4)_2\text{C}_2\text{O}_4 + \text{H}_2\text{O}$, is used in wool dyeing as an addition when dyeing Acid Alizarine Black SE and SET and also for correcting water. It is prepared by neutralising Oxalic acid and Ammonia. For 300 parts of Oxalic acid about 400 parts of Ammonia are required.

6. Magnesium Compounds.

Magnesium Oxide or Burnt Magnesia, MgO , mol. weight 40, forms a white amorphous powder, which is used for producing the various magnesium mordants.

Magnesium Carbonate, MgCO_3 , mol. weight 84, is used in printing resists under Aniline Black.

Magnesium Chloride $\text{MgCl}_2 + 6\text{H}_2\text{O}$, mol. weight 203, is put upon the market either in crystals or calcined form, and dissolves easily in water. Owing to its hygroscopic character it is used as an addition to finishes, in order to retain moisture in finished goods.

Magnesium Sulphate or Epsom Salt, $\text{MgSO}_4 + 7\text{H}_2\text{O}$, mol. weight 246 (soluble in 4 parts of cold and in $1\frac{1}{2}$ parts of hot water), is chiefly used for finishing cotton goods.

Magnesium Acetate, $\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2 + 4\text{H}_2\text{O}$, mol. weight 214, is obtained by dissolving magnesium carbonate in acetic acid. It is used in solution of 40° Tw. as a resist for Aniline Black.

7. Calcium Compounds.

Calcium Oxide, Caustic Lime, Quick Lime or Burnt Lime, CaO , mol. weight 56, is obtained by burning calcium carbonate. It forms a white amorphous, poisonous substance which in absorbing moisture develops heat. By the action of water upon

quick lime calcium hydroxide (slaked lime) is generated, which is employed in bleaching, vat dyeing, for producing calcium mordants etc.

Quantities of Calcium Oxide in Milk of Lime at 59°F
(Lunge und Blattner).

| De- grees Bé | Weight of 1 litre Milk of Lime in grs. | CaO in 1 litre grs. | CaO Weight per cent. | De- grees Bé | Weight of 1 litre Milk of Lime in grs. | CaO in 1 litre grs. | CaO Weight per cent. |
|--------------------|---|---------------------------|-------------------------------|--------------------|---|---------------------------|-------------------------------|
| 1 | 1007 | 7.5 | 0.745 | 16 | 1125 | 159 | 14.13 |
| 2 | 1014 | 16.5 | 1.64 | 17 | 1134 | 170 | 15.00 |
| 3 | 1022 | 26 | 2.54 | 18 | 1142 | 181 | 15.85 |
| 4 | 1029 | 36 | 3.54 | 19 | 1152 | 193 | 16.75 |
| 5 | 1037 | 46 | 4.43 | 20 | 1162 | 206 | 17.72 |
| 6 | 1045 | 56 | 5.36 | 21 | 1171 | 218 | 18.61 |
| 7 | 1052 | 65 | 6.18 | 22 | 1180 | 229 | 19.40 |
| 8 | 1060 | 75 | 7.08 | 23 | 1190 | 242 | 20.34 |
| 9 | 1067 | 84 | 7.87 | 24 | 1200 | 255 | 21.25 |
| 10 | 1075 | 94 | 8.74 | 25 | 1210 | 268 | 22.15 |
| 11 | 1083 | 104 | 9.60 | 26 | 1220 | 281 | 23.04 |
| 12 | 1091 | 115 | 10.45 | 27 | 1231 | 295 | 23.96 |
| 13 | 1100 | 126 | 11.45 | 28 | 1241 | 309 | 24.90 |
| 14 | 1108 | 137 | 12.35 | 29 | 1252 | 324 | 25.87 |
| 15 | 1116 | 148 | 13.26 | 30 | 1263 | 339 | 26.84 |

Calcium Carbonate or Chalk, CaCO_3 , mol. weight 100 serves for neutralising purposes, e. g. it neutralises the acid which is liberated in fixing Basic colours with Tartar Emetic and is used as an addition to Alizarine Red dyebaths.

Chloride of Lime, CaOCl_2 , mol. weight 127, is put upon the market as a smooth white powder, free from any hard lumps. In the open air it absorbs moisture and carbonic acid, and becomes soft and greasy. It dissolves in 20 parts of water. In dissolving it leaves an insoluble residue of caustic lime. Chloride of Lime must be kept in well closed vessels and in a dry place, it serves for chlorinating wool intended for printing. Chloride of Lime should contain about 35% effective chlorine. The analysis is made by titration with arsenious acid.

Specific Gravity of Solutions of Chloride of Lime
at 59° F.

W. Ebert.

| Spec. Grav. | De-grees B \acute{e} | Grs. effective chlorine per litre | Spec. Grav. | De-grees B \acute{e} | Grs. effective chlorine per litre | Spec. Grav. | De-grees B \acute{e} | Grs. effective chlorine per litre |
|-------------|------------------------|-----------------------------------|-------------|------------------------|-----------------------------------|-------------|------------------------|-----------------------------------|
| 1,0000 | 0,0 | Trace | 1,0258 | 3,63 | 15,0 | 1,0539 | 7,38 | 32,0 |
| 1,0018 | 0 26 | 1,0 | 1,0275 | 3,86 | 16,0 | 1,055 | 7,52 | 32,68 |
| 1,0025 | 0,36 | 1,40 | 1,029 | 4,09 | 17,0 | 1,057 | 7,79 | 34,0 |
| 1,0036 | 0,52 | 2,0 | 1,03 | 4,20 | 17,36 | 1,06 | 8,11 | 35,81 |
| 1,005 | 0,73 | 2,71 | 1,031 | 4,33 | 18,0 | 1,0603 | 8,21 | 36,0 |
| 1,0054 | 0,78 | 3,0 | 1,0325 | 4,54 | 19,0 | 1,0633 | 8,59 | 38,0 |
| 1,007 | 1,03 | 4,0 | 1,034 | 4,77 | 20,0 | 1,065 | 8,81 | 39,10 |
| 1,009 | 1,29 | 5,0 | 1,035 | 4,88 | 20,44 | 1,0664 | 8,99 | 40,0 |
| 1,01 | 1,43 | 5,88 | 1,0357 | 4,97 | 21,0 | 1,0695 | 9,38 | 42,0 |
| 1,0108 | 1,54 | 6,0 | 1,0374 | 5,20 | 22,0 | 1,07 | 9,44 | 42,31 |
| 1,0126 | 1,78 | 7,0 | 1,039 | 5,41 | 23,0 | 1,0726 | 9,77 | 44,0 |
| 1,014 | 2,02 | 8,0 | 1,04 | 5,55 | 23,75 | 1,075 | 10,07 | 45,70 |
| 1,015 | 2,13 | 8,48 | 1,0407 | 5,64 | 24,0 | 1,0756 | 10,14 | 46,0 |
| 1,016 | 2,27 | 9,0 | 1,042 | 5,86 | 25,0 | 1,0786 | 10,52 | 48,0 |
| 1,0177 | 2,51 | 10,0 | 1,044 | 6,08 | 26,0 | 1,08 | 10,69 | 48,9 |
| 1,0194 | 2 75 | 11,0 | 1,045 | 6,21 | 26,62 | 1,0817 | 10,89 | 50,0 |
| 1,02 | 2 89 | 11,41 | 1,046 | 6,31 | 27,0 | 1,0848 | 11,28 | 52,0 |
| 1,025 | 2,97 | 12,0 | 1,0474 | 6,53 | 28,0 | 1,085 | 11,3 | 52,27 |
| 1,0236 | 3,19 | 13,0 | 1,049 | 6,73 | 29,0 | 1,09 | 11,92 | 55,18 |
| 1,024 | 3,41 | 14,0 | 1,05 | 6,87 | 29,60 | | | |
| 1,025 | 3,52 | 14,47 | 1,0506 | 6,95 | 30,0 | | | |

Diluted Solutions of Chloride of Lime, e. g. such as are used in bleaching, cannot be reliably determined by the areometer. The following method is sufficient for practical purposes, and is specially suitable for controlling the chemicking operations:

An Indigo solution is prepared with

15 g Indigo Carmine paste

10 g Sulphuric acid 169° Tw., made up with water to 1 litre.

A portion of chloride of lime solution $\frac{3}{4}$ ° Tw. mixed with an equal volume of above solution effects decoloration.

Calcium Sulpho Cyanide $\text{Ca}(\text{CNS})_2 + 2\text{H}_2\text{O}$, mol. weight 192, is put upon the market as a white easily deliquescent substance or as a solution, and is used as a mordant in the printing of Alizarine Red and Pink. Sulpho Cyanide of Calcium must be free from iron.

Specific Gravity of Solutions of Calcium Sulpho
Cyanide at 62 $\frac{1}{2}$ ° F.

| Spec. Grav. | De- grees Bé | g Ca (CNS) ₂ per litre | g Ca O per litre | Spec. Grav. | De- grees Bé | g Ca (CNS) ₂ per litre | g Ca O per litre |
|----------------|--------------------|---|---------------------|----------------|--------------------|---|---------------------|
| 1.132 | 16.7 | 200 | 79.4 | 1.066 | 8.8 | 110 | 39.7 |
| 1.126 | 16.1 | 210 | 75.8 | 1.060 | 8.0 | 100 | 36.0 |
| 1.121 | 15.5 | 201.24 | 72.24 | 1.054 | 7.3 | 90 | 32.4 |
| 1.114 | 14.7 | 190 | 68.6 | 1.048 | 6.5 | 80 | 28.8 |
| 1.108 | 13.9 | 180 | 65.0 | 1.042 | 5.7 | 70 | 25.2 |
| 1.102 | 13.2 | 170 | 61.4 | 1.036 | 4.9 | 60 | 21.6 |
| 1.096 | 12.5 | 160 | 57.8 | 1.030 | 4.1 | 50 | 18.0 |
| 1.090 | 11.9 | 150 | 54.2 | 1.024 | 3.3 | 40 | 14.4 |
| 1.084 | 11.1 | 140 | 50.6 | 1.018 | 2.5 | 30 | 10.8 |
| 1.078 | 10.4 | 130 | 47.0 | 1.012 | 1.7 | 20 | 7.2 |
| 1.072 | 9.6 | 120 | 43.4 | 1.006 | 0.9 | 10 | 3.6 |

Calcium Acetate or Acetate of Lime $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 + \text{H}_2\text{O}$, mol. weight 176, is produced from burnt lime and acetic acid in the following manner:

- 35 lbs. (3.5 kos) pure burnt lime are slaked with
- 5 gall (5 litres) water, and diluted with
- 7 gall (7 litres) water. Then are added
- 20 gall (20 litres) acetic acid 9° Tw., and allowed to stand for 12 to 24 hours.

The clear alkaline solution is drained off from the sediment (containing iron), then acetic acid is added until a slight acid reaction sets in, and finally the solution reduced to 28 $\frac{1}{2}$ ° Tw.

It is used as an addition to Alizarine steam colours, especially to Alizarine Red and Pink, for which purpose it must be perfectly free from iron.

Specific Gravity of Solutions of Calcium Acetate
at 59° F.

| Spec. Grav. | Degrees Bé | Per cent Ca (C ₂ H ₃ O ₂) ₂ | Spec. Grav. | Degrees Bé | Per cent Ca (C ₂ H ₃ O ₂) ₂ |
|----------------|---------------|---|----------------|---------------|---|
| 1.0260 | 3.4 | 5 | 1.1051 | 13.6 | 20 |
| 1.0530 | 7.1 | 10 | 1.1321 | 16.8 | 25 |
| 1.0792 | 10.5 | 15 | 1.1594 | 19.8 | 30 |

Pyrolignite of Lime is put upon the market in brown lumps, and is produced by neutralisation of pyroligneous acid with milk of lime. Owing to its lower price it is used for the preparation of aluminium and chrome mordants.

Calcium Oxalate, $\text{C}_2\text{O}_4\text{Ca}$, mol. weight 128, is produced by neutralising oxalic acid with chalk. It is used as an addition to Chromate discharges on Indigo, where by the oxalic acid can be dispensed with in soaping.

8. Barium Compounds.

Barium Chloride, $\text{BaCl}_2 + 2\text{H}_2\text{O}$, mol. weight 244 (soluble in 3 parts of cold or in 2 parts of hot water) is put upon the market in rhombic crystals or scales. It is used for the preparation of Barium Chromate for the production of opal effects with Sodium Tungstate.

Barium Chlorate, $\text{Ba}(\text{ClO}_3)_2 + \text{H}_2\text{O}$, mol. weight 322, (soluble in 4 parts of cold or in $\frac{2}{4}$ parts of hot water) is put upon the market in monoclinic crystals. It is used for the production of Aluminium Chlorate.

Barium Sulpho Cyanide, $\text{Ba}(\text{CNS})_2 + 2\text{H}_2\text{O}$, mol. weight 289, is used for the production of aluminium sulpho cyanide mordants by treating with Sulphate of Alumina.

9. Aluminium Compounds.

Aluminium Hydroxide or Hydrate of Alumina, $\text{Al}_2(\text{OH})_6$, mol. weight 155,8 is put upon the market in the form of lumps or as a paste. It is obtained by precipitating aluminium sulphate solutions with soda. The precipitate thus produced, contains Sulphuric acid. Aluminium hydroxide free from sulphuric acid is obtained by precipitating hot aluminium sulphate solutions with ammonia, and then washing well. Alumina Hydrate is used for the production of the various Aluminium mordants.

Sodium Aluminate, $\text{Na}_3\text{Al}_2\text{O}_4$, mol. weight 164, is obtained by dissolving freshly precipitated alumina hydrate in caustic soda. It is used as a mordant on Alizarin Red.

Aluminium Chloride, Al_2Cl_6 , mol. weight 266,5 is used, as a solution of 53° Tw. and on account of its easy dissociation it is frequently employed for printing colours produced upon the fibre by oxidation. It is also used for carbonising woollen piece goods which do not withstand carbonising with Sulphuric acid, especially piece goods which are carbonised after dyeing.

Specific Gravity of Solutions of Aluminium Chloride
at 59° F.
(Gerlach.)

| Spec. Grav. | Per cent Al_2Cl_6 | Spec. Grav. | Per cent Al_2Cl_6 | Spec. Grav. | Per cent Al_2Cl_6 | Spec. Grav. | Per cent Al_2Cl_6 |
|----------------|---|----------------|---|----------------|---|----------------|---|
| 1.00721 | 1 | 1.08902 | 12 | 1.17953 | 23 | 1.28080 | 34 |
| 1.01443 | 2 | 1.09684 | 13 | 1.18815 | 24 | 1.29046 | 35 |
| 1.02164 | 3 | 1.10466 | 14 | 1.19676 | 25 | 1.30006 | 36 |
| 1.02885 | 4 | 1.11248 | 15 | 1.20584 | 26 | 1.31086 | 37 |
| 1.03603 | 5 | 1.12073 | 16 | 1.21493 | 27 | 1.32106 | 38 |
| 1.04353 | 6 | 1.12987 | 17 | 1.22406 | 28 | 1.33126 | 39 |
| 1.05099 | 7 | 1.13721 | 18 | 1.23310 | 29 | 1.34146 | 40 |
| 1.05845 | 8 | 1.14545 | 19 | 1.24219 | 30 | 1.35224 | 41 |
| 1.06591 | 9 | 1.15370 | 20 | 1.25184 | 31 | 1.35359 | 41.126 |
| 1.07337 | 10 | 1.16231 | 21 | 1.26149 | 32 | | |
| 1.08120 | 11 | 1.17092 | 22 | 1.27115 | 33 | | |

Aluminium Sulphate or Sulphate of Alumina, $\text{Al}_2(\text{SO}_4)_3$
+ $18\text{H}_2\text{O}$, mol. weight 664.8 (soluble in 10 parts of cold and $\frac{1}{10}$ part
of hot water) is a substitute for alum. It is used for the production of
various aluminium mordants, and for this purpose must be free from iron.

Specific Gravity of Solutions of Aluminium Sulphate
at 59° F.

| Spec. Grav. | Per cent $\text{Al}_2(\text{SO}_4)_3$ | Spec. Grav. | Per cent $\text{Al}_2(\text{SO}_4)_3$ | Spec. Grav. | Per cent $\text{Al}_2(\text{SO}_4)_3$ |
|----------------|--|----------------|--|----------------|--|
| 1.0170 | 1 | 1.1071 | 10 | 1.1971 | 19 |
| 1.0270 | 2 | 1.1171 | 11 | 1.2074 | 20 |
| 1.0370 | 3 | 1.1270 | 12 | 1.2168 | 21 |
| 1.0470 | 4 | 1.1369 | 13 | 1.2274 | 22 |
| 1.0569 | 5 | 1.1467 | 14 | 1.2375 | 23 |
| 1.0670 | 6 | 1.1574 | 15 | 1.2473 | 24 |
| 1.0768 | 7 | 1.1668 | 16 | 1.2573 | 25 |
| 1.0870 | 8 | 1.1770 | 17 | | |
| 1.0968 | 9 | 1.1876 | 18 | | |

Clay. Under the name of Clay, Kaoline or China Clay a compound of alumina and silicic acid is put upon the market. It forms a white powder and is used as an addition to white discharges and resists. It is principally employed in finishing.

Fullers Earth is an impure clay of greenish, yellowish, brownish or reddish colour; it has a greasy handle and forms a pulpy mass with water. It is used for milling and for washing woollen goods which have been dyed with mordant colours etc. It should be free from impurities such as sand and stone.

Potassium Aluminium Sulphate or **Potash Alum**, $K_2SO_4 \cdot Al_2(SO_4)_3 + 24H_2O$, mol. weight 948 (soluble in 10 parts of cold or $\frac{1}{4}$ part of hot water), forms large colourless octahedra. Like sulphate of alumina it is used for the production of aluminium mordants.

Besides the above mentioned uses, alum is also employed in wool dyeing for souing off Alkaline Blue and as an assistant mordant when dyeing Resorcline colours. Further, it serves as a mordant for Alizarine Red, Alizarine Orange etc. as well as for the after-treatment of certain developing colours.

Specific Gravity of Solutions of Potash Alum at 63° F.
(Gerlach.)

| Spec. Grav. | Per cent Al_2K_2 $(SO_4)_4$ | Per cent $Al_2K_2(SO_4)_4$ $+ 24H_2O$ | Spec. Grav. | Per cent Al_2K_2 $(SO_4)_4$ | Per cent $Al_2K_2(SO_4)_4$ $+ 24H_2O$ |
|----------------|-------------------------------------|---|----------------|-------------------------------------|---|
| 1.0205 | 2.1702 | 4 | 1.0635 | 6.5379 | 13 |
| 1.0415 | 4.3548 | 8 | 1.0690 | 7.0824 | 13 |

Ammonium Aluminium Sulphate or **Ammonia Alum**, $(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 + 24H_2O$, mol. weight 904.4 (soluble in 10 parts of cold water and very soluble in hot water), forms large colourless octahedra. It is used instead of potash alum for the production of aluminium mordants.

Aluminium Acetate or **Acetate of Alumina**, $Al_2(C_2H_3O_2)_6$, mol. weight 408, is obtained by dissolving aluminium hydrate in acetic acid, or by the interaction of aluminium sulphate or alum and sugar of lead or acetate of lime.

Acetate of Alumina is used as a mordant in dyeing, and for water-proofing, and is prepared according to the following recipes:

I.

1250 g Alumina Hydrate 12% are heated with
1000 g Acetic Acid 9° Tw. filtered, and diluted with
water to 15° Tw.

II.

| | | |
|---|-----------|---------------------|
| { | 665 parts | Sulphate of Alumina |
| { | 1000 " | Water |
| { | 1137 " | Sugar of Lead |
| { | 1900 " | Water |

each to be separately dissolved hot, precipitated and diluted to 15° Tw.

Specific Gravity of Solutions of Acetate of Alumina
at 63° F.

| Spec. Grav. | Degrees Bé | grs. Al_2O_3 per litre | Spec. Grav. | Degrees Bé | grs. Al_2O_3 per litre |
|----------------|---------------|---|----------------|---------------|---|
| 1,100 | 13,0 | 40,8 | 1,050 | 6,7 | 20 |
| 1,098 | 12,8 | 40 | 1,038 | 5,0 | 15 |
| 1,086 | 11,3 | 35 | 1,025 | 3,4 | 10 |
| 1,074 | 9,9 | 30 | 1,012 | 1,6 | 5 |
| 1,062 | 8,3 | 25 | | | |

Aluminium Sulpho-Acetate or **Sulphate-Acetate of Alumina** is obtained when a quantity of sugar of lead insufficient for completing the chemical interchange is used. It yields a normal and basic sulpho-acetate. The normal sulpho-acetate is used in printing, the basic aluminium acetates in dyeing with Alizarine Red.

I Normal Sulpho-Acetate. II. Basic Sulpho-Acetate.

| | | |
|---|------------|---------------------|
| { | 6650 parts | Sulphate of Alumina |
| { | 6000 " | Water |
| { | 9450 " | Sugar of Lead |
| { | 9000 " | Water |

each to be separately dissolved hot, precipitated and diluted to 15° Tw.

| | | |
|---|------------|--------------------|
| { | 1908 parts | Alum or |
| { | 1336 " | Acetate of Alumina |
| { | 2000 " | Water |
| { | 1590 " | Sugar of Lead |
| { | 1600 " | Water |

each to be separately dissolved hot, and precipitated. After cooling

150 parts Crystal Soda are added and the whole left to stand for 24 hours, decanted and diluted to 18° Tw.

Aluminium Sulpho-Cyanide, $\text{Al}_2(\text{CNS})_6$, mol. weight 402, is produced from sulphate of alumina and cyanide of barium. As it does not corrode the steel doctors in printing, and slight impurities of iron in the mordant are counteracted by it, it is used as a mordant for Alizarine Red and Alizarine Pink. It also acts as a resist for Aniline Black.

Sulpho Cyanide of Aluminium 18° Tw.

| | | |
|---|------------|-----------------------------------|
| { | 6300 parts | Sulphate of Alumina, dissolved in |
| { | 10000 | „ Water |
| { | 8500 | „ Cyanide of Barium, dissolved in |
| { | 10000 | „ Water |

are mixed, decanted and filtered, and the filtered liquid is diluted to 18° Tw.

Specific Gravity of Solutions of Sulpho-Cyanide of Aluminium at 63° F.

(Produced from Alumina and Barium Sulpho-Cyanide)

| Spec. Grav. | De-grees Bé | grs. Al_2O_3 per litre | Spec. Grav. | De-grees Bé | grs. Al_2O_3 per litre | Spec. Grav. | De-grees Bé | grs. Al_2O_3 per litre |
|-------------|-------------|--|-------------|-------------|--|-------------|-------------|--|
| 1,209 | 24.9 | 35 | 1,135 | 17.1 | 23.5 | 1,059 | 7.9 | 10 |
| 1,194 | 23.4 | 32.5 | 1,119 | 15.3 | 20 | 1,044 | 5.9 | 7.5 |
| 1,179 | 21.9 | 30 | 1,104 | 13.5 | 17.5 | 1,029 | 4.0 | 5 |
| 1,164 | 20.2 | 27.5 | 1,089 | 11.8 | 15 | 1,015 | 2.2 | 2.5 |
| 1,149 | 18.7 | 25 | 1,074 | 9.9 | 12.5 | | | |

Aluminium Nitrate, $\text{Al}(\text{NO}_3)_3 + 15\text{H}_2\text{O}$, mol. weight 694.7, forms easily soluble crystals, and is obtained by dissolving aluminium hydrate in nitric acid or by the interchange of sulphate of alumina with nitrate of lead. It dissociates neither by heating nor by dilution with water, and is used as a mordant for Alizarine Red steam colours.

Specific Gravity of Solutions of Aluminium Nitrate at 63° F.

| Spec. Grav. | De-grees Bé | grs. Al_2O_3 per litre | Spec. Grav. | De-grees Bé | grs. Al_2O_3 per litre | Spec. Grav. | De-grees Bé | grs. Al_2O_3 per litre |
|-------------|-------------|--|-------------|-------------|--|-------------|-------------|--|
| 1,156 | 19.3 | 49.42 | 1,115 | 14.9 | 37 | 1,059 | 7.9 | 20 |
| 1,145 | 18.3 | 46 | 1,108 | 14 | 35 | 1,043 | 5.8 | 15 |
| 1,135 | 17.1 | 43 | 1,091 | 12 | 30 | 1,027 | 3.7 | 10 |
| 1,125 | 16 | 40 | 1,075 | 10 | 25 | 1,013 | 1.7 | 5 |

Aluminium Nitro-Acetate or Nitrate-Acetate of Alumina, nitrate mordant, is obtained by a double interchange of sulphate of alumina or alum with sugar of lead and nitrate of lead, or with acetate and nitrate of lime. It dissociates very slowly in steaming, and is therefore suitable as a mordant for Alizarine Red.

Nitrate Mordant.

{ 667 parts Sulphate of Alumina are dissolved in
 { 1000 „ Water; then are added
 { 786 „ Acetate of Lime 23° Tw. and
 { 886 Nitrate of Lime 67° Tw.
 the whole diluted to 3200 parts and filtered. Or
 6 parts Alum are precipitated with
 4 „ Sugar of Lead and
 2 „ Nitrate of Lead.

Specific Gravity of Solutions of Nitrate Mordant (Nitro-Acetate of Alumina) at 63° F.

| Spec. Grav. | Degrees Bé | grs. Al_2O_3 per litre | Spec. Grav. | Degrees Bé | grs. Al_2O_3 per litre |
|----------------|---------------|---|----------------|---------------|---|
| 1,160 | 19,8 | 56,4 | 1,083 | 11,0 | 30 |
| 1,156 | 19,4 | 55 | 1,068 | 9,1 | 25 |
| 1,141 | 17,8 | 50 | 1,054 | 7,2 | 20 |
| 1,126 | 16,1 | 45 | 1,039 | 5,3 | 15 |
| 1,112 | 14,4 | 40 | 1,025 | 3,4 | 10 |
| 1,097 | 12,7 | 35 | 1,012 | 1,6 | 5 |

Tartrate of Alumina is used as a mordant in printing, according to the following recipe:

Tartrate of Alumina 23° Tw.

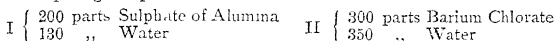
1500 parts Alumina Hydrate 50% are made into a paste with
 2200 „ Hot Water, to which is added a solution of
 720 „ Tartaric Acid dissolved in
 1500 „ Water.

After heating the solution is diluted to 23° Tw.

Specific Gravity of Solutions of Tartrate of Alumina
at 63° F.

| Spec. Grav. | Degrees Bé | grs. Al_2O_3 per litre | Spec. Grav. | Degrees Bé | grs Al_2O_3 per litre |
|-------------|------------|--|-------------|------------|---------------------------------------|
| 1,390 | 40,5 | 130 | 1,195 | 23,5 | 65 |
| 1,375 | 39,4 | 125 | 1,180 | 22,0 | 60 |
| 1,360 | 38,2 | 120 | 1,165 | 20,4 | 55 |
| 1,345 | 37,0 | 115 | 1,150 | 18,8 | 50 |
| 1,330 | 35,8 | 110 | 1,135 | 17,1 | 45 |
| 1,315 | 34,6 | 105 | 1,120 | 15,4 | 40 |
| 1,300 | 33,3 | 100 | 1,105 | 13,6 | 35 |
| 1,285 | 32,0 | 95 | 1,090 | 11,9 | 30 |
| 1,270 | 30,6 | 90 | 1,075 | 10,0 | 25 |
| 1,255 | 29,3 | 85 | 1,060 | 8,0 | 20 |
| 1,240 | 27,9 | 80 | 1,045 | 6,0 | 15 |
| 1,225 | 26,4 | 75 | 1,030 | 4,1 | 10 |
| 1,210 | 25,0 | 70 | 1,015 | 2,1 | 5 |

Aluminium Chlorate or **Chlorate of Alumina**, $\text{Al}(\text{ClO}_3)_3$, mol. weight 277,6, is an exceptionally unstable compound, which is used the production of strong oxidation discharges. It is produced by decomposing Sulphate of Alumina with Barium Chlorate:



I and II are mixed together, cooled, the precipitate allowed to settle, and the clear solution made up to 42° Tw with water. In certain cases Aluminium Chlorate is produced direct in the printing colours by mixing Sulphate of Alumina with Barium or Sodium Chlorate.

Specific Gravity of Solutions of Chlorate of Alumina
at 63° F.

(Produced from Barium Chlorate and Sulphate of Alumina.)

| Spec. Grav. | Degrees Bé | grs Al_2O_3 per litre | Spec. Grav. | Degrees Bé | grs Al_2O_3 per litre |
|-------------|------------|---------------------------------------|-------------|------------|---------------------------------------|
| 1,302 | 33,5 | 65 | 1,160 | 19,8 | 35 |
| 1,277 | 31,3 | 60 | 1,138 | 17,4 | 30 |
| 1,252 | 29,0 | 55 | 1,116 | 15,0 | 25 |
| 1,235 | 27,4 | 51,8 | 1,095 | 12,4 | 20 |
| 1,227 | 26,6 | 50 | 1,073 | 9,8 | 15 |
| 1,205 | 24,5 | 45 | 1,050 | 6,7 | 10 |
| 1,182 | 22,2 | 40 | 1,026 | 3,5 | 5 |

10. Chromium Compounds

Chromic oxide, $\text{Cr}_2(\text{OH})_6$, mol. weight 207 is prepared by precipitating chrome alum with ammonia. Acetate of Chrome is produced from Chromic Oxide by dissolving it in Acetic acid.

Chrome Alum, $\text{K}_2\text{SO}_4 \cdot \text{Cr}_2(\text{SO}_4)_3 + 24 \text{H}_2\text{O}$, mol. weight 999, is put upon the market in dark violet octahedra. It is used for the preparation of chrome mordants.

Bisulphite of Chrome, $\text{Cr}_2(\text{HSO}_3)_6$, is obtained by mixing a chrome alum solution with bisulphite. It is decomposed by steaming when chromium hydrate is formed. It is used as a mordant in dyeing.

Specific Gravity of Solution of Bisulphite of Chrome
at 63° F.

| Spec. Grav. | Degrees Bé | grs Cr_2O_3 per litre | Spec. Grav. | Degrees Bé | grs. Cr_2O_3 per litre |
|----------------|---------------|--|----------------|---------------|---|
| 1,160 | 19,8 | 80 | 1,080 | 10,6 | 40 |
| 1,150 | 18,8 | 75 | 1,070 | 9,4 | 35 |
| 1,140 | 17,7 | 70 | 1,060 | 8,0 | 30 |
| 1,130 | 16,5 | 65 | 1,050 | 6,7 | 25 |
| 1,120 | 15,4 | 60 | 1,040 | 5,4 | 20 |
| 1,110 | 14,2 | 55 | 1,030 | 4,1 | 15 |
| 1,100 | 13,0 | 50 | 1,020 | 2,7 | 10 |
| 1,090 | 11,9 | 45 | 1,010 | 1,4 | 5 |

Acetate of Chrome, $\text{Cr}_2(\text{C}_2\text{H}_3\text{O}_2)_6$, mol. weight 458,6, is obtained by dissolving chromium hydrate in acetic acid, by the reaction of chrome alum upon sugar of lead or acetate of lime, or by the reduction of bichromate of potassium with glucose. Two modifications of acetate of chrome are sold: the green or normal acetate, $\text{Cr}_2(\text{CH}_3\text{COO})_6$, and the violet or basic acetate, $\text{Cr}_2(\text{CH}_3\text{COO})_4(\text{OH})_2$. The addition of sodium acetate to acetate of chrome diminishes its faculty of being precipitated by alkalis. It is not easily decomposed. Basic chrome acetates are obtained by an addition of soda to normal acetate of chrome. Only very basic acetates dissociate on heating. Acetate of chrome is an important mordant in calico printing, the green acetate of chrome being used for the production of blue and khaki shades.

Directions for preparing Acetate of Chrome.

1.

1200 parts Chromium Hydrate
and
1300 parts Acetic acid 9° Tw.
are heated on the water
bath until completely dissol-
ved, and dilute to 25° Tw.

2.

{ 1200 parts Chrome alum
{ 2400 „ Water
{ 1200 „ Sugar of Lead
{ 1000 „ Water
are precipitated
filtered and washed,
and then diluted to
32½° Tw.

3.

{ 1200 parts Sodium Bichromate
{ 1250 „ Water
{ 3000 „ Acetic acid 9° Tw., to which are
gradually added
756 „ Glucose

the whole is heated until the solution shows a green colour, and then
diluted to 32½° Tw.

Certain dyestuffs which require to be dissolved in alkalis, can
only be used in combination with neutral acetate of chrome. This is
produced as follows:

{ 1000 parts Acetate of Chrome 32½° Tw.
{ 20 „ Glycerine
{ 8 „ Soda
{ 71 „ Water.

Specific Gravity of Solutions of Normal (Green)
Sextuple Acetate of Chrome at 63° F.

| Spec. Grav. | Degrees Bé | grs. Cr ₂ O ₃ per litre | Spec. Grav. | Degrees Bé | grs. Cr ₂ O ₃ per litre |
|----------------|---------------|--|----------------|---------------|--|
| 1,007 | 1 | 5 | 1,084 | 11,1 | 60 |
| 1,014 | 2 | 10 | 1,091 | 12,0 | 65 |
| 1,021 | 3 | 15 | 1,098 | 12,8 | 70 |
| 1,028 | 4 | 20 | 1,105 | 13,6 | 75 |
| 1,035 | 4,9 | 25 | 1,112 | 14,5 | 80 |
| 1,042 | 5,8 | 30 | 1,119 | 15,3 | 85 |
| 1,049 | 6,6 | 35 | 1,126 | 16,1 | 90 |
| 1,056 | 7,5 | 40 | 1,133 | 16,9 | 95 |
| 1,063 | 8,4 | 45 | 1,140 | 17,6 | 100 |
| 1,070 | 9,3 | 50 | 1,147 | 18,5 | 105 |
| 1,077 | 10,2 | 55 | 1,151 | 19 | 107 |

Specific Gravity of Solutions of Basic (Violet)
Acetate of Chrome at 59° F.

| Spec. Grav. | Degrees Bé | grs. Cr_2O_3 per litre | Spec. Grav. | Degrees Bé | grs. Cr_2O_3 per litre |
|----------------|---------------|---|----------------|---------------|---|
| 1.006 | 1.0 | 5 | 1.089 | 11.8 | 70 |
| 1.013 | 2.0 | 10 | 1.096 | 12.5 | 75 |
| 1.019 | 2.7 | 15 | 1.102 | 13.2 | 80 |
| 1.025 | 3.4 | 20 | 1.108 | 13.9 | 85 |
| 1.031 | 4.2 | 25 | 1.115 | 14.9 | 90 |
| 1.037 | 5.0 | 30 | 1.122 | 15.7 | 95 |
| 1.043 | 5.8 | 35 | 1.129 | 16.4 | 100 |
| 1.050 | 6.7 | 40 | 1.136 | 17.3 | 105 |
| 1.056 | 7.5 | 45 | 1.143 | 18.0 | 110 |
| 1.063 | 8.4 | 50 | 1.150 | 18.8 | 115 |
| 1.069 | 9.3 | 55 | 1.157 | 19.5 | 120 |
| 1.076 | 10.1 | 60 | 1.161 | 19.9 | 122 |
| 1.083 | 11.0 | 65 | | | |

Chromaline D: Under this name Messrs Eberle & Co., of Stuttgart, have put upon the market a preparation which can be obtained in both a solid and liquid form. Chromaline is a substitute for Acetate of Chrome and Fluoride of Chrome in printing, especially in slubbing printing. It yields its chromium oxide more readily than the two latter preparations, without decomposing to any great extent.

Chromium Chloride, Cr_2Cl_6 , mol. weight 317.3, is prepared by dissolving chromium hydrate in hydrochloric acid or by the double decomposition of chrome alum with calcium chloride or by the reduction of bichromate in the presence of Hydrochloric acid. By dissolving chromium hydrate in chromium chloride, a basic chromium chloride $\text{CrCl}(\text{OH})_2$, mol. weight 121.5, is obtained. This basic chloride is used as a mordant for cotton yarn.

Specific Gravity of Solutions of Chromium Chloride
at 59° F.

| Spec. Grav. | Degrees Bé | grs. Cr_2O_3 per litre | Spec. Grav. | Degrees Bé | grs. Cr_2O_3 per litre |
|----------------|---------------|---|----------------|---------------|---|
| 1.008 | 1.2 | 5 | 1.148 | 18.6 | 90 |
| 1.016 | 2.3 | 10 | 1.164 | 20.2 | 100 |
| 1.032 | 4.3 | 20 | 1.180 | 22.0 | 110 |
| 1.048 | 6.5 | 30 | 1.197 | 23.8 | 120 |
| 1.065 | 8.7 | 40 | 1.213 | 25.3 | 130 |
| 1.082 | 10.9 | 50 | 1.229 | 26.8 | 140 |
| 1.098 | 12.9 | 60 | 1.245 | 28.4 | 150 |
| 1.115 | 14.9 | 70 | 1.261 | 29.8 | 160 |
| 1.131 | 16.6 | 80 | 1.276 | 31.2 | 170 |

Alkaline Chrome Mordants. I. An easily fixable mordant for chrome colours has been prepared by Horace K  chlin by mixing:

| | |
|------------|---|
| 250 parts | Acetate of Chrome $32\frac{1}{2}^{\circ}$ Tw. |
| 320 „ | Caustic Soda $71\frac{1}{2}$ Tw. |
| 10 „ | Glycerine 53° Tw. |
| 420 „ | Water |
| <hr/> | |
| 1000 parts | |

II. According to Henri Schmid an alkaline mordant can be obtained by dissolving chromium hydrate in caustic soda.

| | |
|------------|---|
| 1000 parts | Chrome Alum are precipitated with |
| 330 „ | Calc. Soda; the precipitate is washed and then dissolved in |
| 50 „ | Caustic Soda 53° Tw. |

By means of alkaline chrome mordants the chromoxide is readily affixed to the cotton fibre; full shades are thus obtained in dyeing without the further use of fixing mediums.

Chrome Mordants GAI, GAII, GAIII, (according to M. von Gallois), are obtained either by dissolving chromium hydrate in chromic acid, alone or mixed with hydrochloric or acetic acid. They can also be obtained by a double chemical interchange. The brand GAII, which contains Acetic acid, is used specially in cotton dyeing, for chrome dyed styles.

Specific Gravity of Solutions of Chrome Mordant GA I
at 59° F.

| Spec. Grav. | De- grees B   | grs. Cr ₂ O ₃ per litre | Spec. Grav. | De- grees B   | grs. Cr ₂ O ₃ per litre | Spec. Grav. | De- grees B   | grs. Cr ₂ O ₃ per litre |
|----------------|---------------------|--|----------------|---------------------|--|----------------|---------------------|--|
| 1,012 | 1,7 | 10 | 1,121 | 15,5 | 110 | 1,230 | 26,9 | 210 |
| 1,023 | 3,1 | 20 | 1,132 | 16,7 | 120 | 1,241 | 28,0 | 220 |
| 1,034 | 4,6 | 30 | 1,143 | 18,1 | 130 | 1,252 | 29,0 | 230 |
| 1,045 | 6,0 | 40 | 1,154 | 19,2 | 140 | 1,263 | 30,0 | 240 |
| 1,056 | 7,6 | 50 | 1,165 | 20,3 | 150 | 1,274 | 31,0 | 250 |
| 1,067 | 9,0 | 60 | 1,176 | 21,5 | 160 | 1,285 | 32,0 | 260 |
| 1,078 | 10,4 | 70 | 1,187 | 22,7 | 170 | 1,296 | 32,9 | 270 |
| 1,089 | 11,8 | 80 | 1,198 | 23,8 | 180 | 1,307 | 33,9 | 280 |
| 1,099 | 12,9 | 90 | 1,208 | 24,8 | 190 | 1,318 | 34,9 | 290 |
| 1,110 | 14,2 | 100 | 1,219 | 25,9 | 200 | 1,325 | 35,4 | 296 |

Specific Gravity of Solutions of Chrome Mordant GA II
at 59° F.

| Spec. Grav. | De- grees Bé | grs. Cr ₂ O ₃ per litre | Spec. Grav. | De- grees Bé | grs. Cr ₂ O ₃ per litre | Spec. Grav. | De- grees Bé | grs. Cr ₂ O ₃ per litre |
|----------------|--------------------|--|----------------|--------------------|--|----------------|--------------------|--|
| 1,015 | 2.1 | 10 | 1,125 | 16.0 | 120 | 1,235 | 27.4 | 230 |
| 1,025 | 3.4 | 20 | 1,135 | 17.1 | 130 | 1,245 | 28.4 | 240 |
| 1,035 | 4.7 | 30 | 1,145 | 18.3 | 140 | 1,255 | 29.4 | 250 |
| 1,045 | 6.0 | 40 | 1,155 | 19.3 | 150 | 1,266 | 30.3 | 260 |
| 1,055 | 7.4 | 50 | 1,165 | 20.3 | 160 | 1,276 | 31.3 | 270 |
| 1,065 | 8.7 | 60 | 1,175 | 21.4 | 170 | 1,287 | 32.2 | 280 |
| 1,075 | 10.0 | 70 | 1,185 | 22.5 | 180 | 1,298 | 33.2 | 290 |
| 1,085 | 11.2 | 80 | 1,195 | 23.5 | 190 | 1,309 | 34.1 | 300 |
| 1,095 | 12.4 | 90 | 1,205 | 24.5 | 200 | 1,320 | 35.1 | 310 |
| 1,105 | 13.6 | 100 | 1,215 | 25.5 | 210 | 1,328 | 35.7 | 317.4 |
| 1,115 | 14.9 | 110 | 1,225 | 26.5 | 220 | | | |

Specific Gravity of Solutions of Chrome Mordant GA III
at 59° F.

| Spec. Grav. | De- grees Bé | grs. Cr ₂ O ₃ per litre | Spec. Grav. | De- grees Bé | grs. Cr ₂ O ₃ per litre | Spec. Grav. | De- grees Bé | grs. Cr ₂ O ₃ per litre |
|----------------|--------------------|--|----------------|--------------------|--|----------------|--------------------|--|
| 1,011 | 1.6 | 10 | 1,118 | 15.2 | 110 | 1,224 | 26.3 | 210 |
| 1,022 | 3.0 | 20 | 1,128 | 16.4 | 120 | 1,235 | 27.4 | 220 |
| 1,033 | 4.5 | 30 | 1,139 | 17.6 | 130 | 1,246 | 28.5 | 230 |
| 1,044 | 5.9 | 40 | 1,149 | 18.7 | 140 | 1,256 | 29.4 | 240 |
| 1,055 | 7.4 | 50 | 1,159 | 19.7 | 150 | 1,267 | 30.4 | 250 |
| 1,065 | 8.7 | 60 | 1,170 | 20.9 | 160 | 1,278 | 31.4 | 260 |
| 1,076 | 10.1 | 70 | 1,181 | 22.1 | 170 | 1,289 | 32.2 | 270 |
| 1,086 | 11.3 | 80 | 1,191 | 23.1 | 180 | 1,300 | 33.3 | 280 |
| 1,097 | 12.6 | 90 | 1,202 | 24.2 | 190 | 1,311 | 34.3 | 290 |
| 1,108 | 13.9 | 100 | 1,213 | 25.3 | 200 | 1,316 | 34.7 | 296 |

Chromium Formiate or **Formiate of Chrome**, Cr₂(HCOO)₆, is put upon the market as a dull green powder, which is easily soluble in water. It is used instead of Acetate of Chrome for fixing mordant and vigoureux colours in slubbing printing.

Chromic Acid, CrO_3 , forms red crystalline needles which are deliquescent and easily soluble in water. It is sometimes used for mordanting wool in a cold bath.

Sodium Chromate, $\text{Na}_2\text{CrO}_4 + 2\text{H}_2\text{O}$, mol. weight 342.5, forms yellow monoclinic crystals. It is produced by neutralising sodium bichromate with Caustic soda or soda and is used for discharging Indigo

Potassium Chromate, K_2CrO_4 , mol. weight 194.5, forms yellow rhombic prisms, and is produced in a similar manner to sodium chromate by neutralising potassium bichromate with caustic soda or potash. It is used instead of Potassium Bichromate.

Sodium Bichromate, $\text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{H}_2\text{O}$, mol. weight 299, forms deliquescent crystals, and is preferred to potassium bichromate on account of its greater solubility in chromate discharges on Indigo, also for chroming baths and for the production of various chrome mordants.

Potassium Bichromate, $\text{K}_2\text{Cr}_2\text{O}_7$, mol. weight 295, (soluble in 8 parts of cold or 1 part of hot water), forms orange red triclinic crystals. It is used as a mordant for wool, and for after-treating chrome developed shades. It is also used on cotton for Indigo discharges, for the preparation of chrome mordants and for chroming baths

Fluoride of Chrome, $\text{Cr}_2\text{F}_6 + 8\text{H}_2\text{O}$, mol. weight 362, is a green crystalline powder, easily soluble in water, and has a corrosive action upon metals. It is used for after-treating Dianil and Thiogene colours, in order to increase their fastness.

Barium Chromate, BaCrO_4 , mol. weight 253, is obtained by precipitating sodium or potassium chromate with Barium chloride. It is insoluble in water and acetic acid and is used in certain cases for discharging Indigo.

For producing Barium Chromate paste 80%

| | |
|---|---|
| { | 200 g Potassium Chromate are dissolved in |
| { | 400 „ Water, and |
| { | 250 „ Barium Chloride are dissolved in |
| { | 750 „ Water. |

The two solutions are simultaneously poured into water whilst stirring constantly. The precipitate is decanted, filtered and pressed to 320 g (80% paste).

Lead Chromate or Chrome Yellow, PbCrO_4 , mol. weight 323, is a fiery yellow substance of high specific gravity and good covering power. It is prepared in the following manner from Potassium Bichromate and Lead Acetate:

| | |
|---|----------------------------|
| { | 300 g Potassium Bichromate |
| { | 80 „ Calcined Soda |
| { | 3 l Water |
| { | 760 g Lead Acetate |
| { | 6 l Water. |

The two solutions are simultaneously poured into 30 litres of water, whilst stirring well, the precipitate is then allowed to settle, decanted three times and filtered.

Chrome Yellow is used as a fast colour and is fixed by means of albumen; it is also used as an intermediate for steam Aniline Black. In many cases Chrome Yellow is produced direct on the fibre, as e. g. in Indigo resist styles. On treating with hot milk of lime neutral lead chromate is converted into a basic chromate known as Chrome Orange.

11. Iron Compounds.

Chloride of Iron, Fe_2Cl_6 , mol. weight 325, is put upon the market in easily deliquescent tablets, and is used in an alkaline solution as a medium for oxidation.

Ferrous Sulphate or Copperas, $\text{FeSO}_4 + 7\text{H}_2\text{O}$, mol. weight 278 (soluble in 2 parts of cold or $\frac{1}{3}$ part of hot water), forms greenish blue monoclinic crystals which are very efflorescent. It is used for the preparation of the various iron mordants, as a reducing agent in vat dyeing, and as a mordant for Logwood Black on wool.

Specific Gravity of Solutions of Ferrous Sulphate,
at 59° F.

| Spec. Grav. | Per cent FeSO_4 + 7 aq. | Spec. Grav. | Per cent FeSO_4 + 7 aq. | Spec. Grav. | Per cent FeSO_4 + 7 aq. |
|----------------|--|----------------|--|----------------|--|
| 1,011 | 2 | 1,054 | 10 | 1,143 | 25 |
| 1,021 | 4 | 1,065 | 12 | 1,174 | 30 |
| 1,032 | 6 | 1,082 | 15 | 1,206 | 35 |
| 1,043 | 8 | 1,112 | 20 | 1,239 | 40 |

Ferrous Acetate or Acetate of Iron, $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_2 + 4\text{H}_2\text{O}$, mol. weight 246, is obtained by dissolving iron in acetic acid or by the double decomposition of copperas with sugar of lead:

68 lbs. Sulphate of Iron

36 „ Sugar of Lead

are dissolved together in water. After being allowed to stand, the liquid is filtered and diluted to 32 $\frac{1}{2}$ ° Tw.

18 gallons

Ferrous Acetate is used specially for the production of buff and tan shades, and in combination with chrome salts, for the production of khaki shades.

Pyrolignite of Iron is obtained by distilling iron pyrites with pyroligneous acid (wood-vinegar) or by the double decomposition of sulphate of iron with pyrolignite of lime. It is extensively used as a mordant in dyeing and for steam Alizarine Violet.

**Specific Gravity of Solutions of Pyrolignite of Iron
at 63° F.**

| Spec. Grav. | De- grees Bé | grs. Fe ₂ O ₃ per litre | Spec. Grav. | De- grees Bé | grs. Fe ₂ O ₃ per litre | Spec. Grav. | De- grees Bé | grs. Fe ₂ O ₃ per litre |
|----------------|--------------------|--|----------------|--------------------|--|----------------|--------------------|--|
| 1,274 | 31.0 | 190 | 1,179 | 21.9 | 125 | 1,088 | 11.7 | 60 |
| 1,266 | 30.3 | 185 | 1,172 | 21.2 | 120 | 1,081 | 10.7 | 55 |
| 1,258 | 29.5 | 180 | 1,165 | 20.3 | 115 | 1,074 | 9.9 | 50 |
| 1,250 | 28.8 | 175 | 1,158 | 19.6 | 110 | 1,067 | 9.0 | 45 |
| 1,242 | 28.0 | 170 | 1,151 | 18.9 | 105 | 1,060 | 8.0 | 40 |
| 1,235 | 27.4 | 165 | 1,144 | 18.2 | 100 | 1,053 | 7.1 | 35 |
| 1,228 | 26.7 | 160 | 1,137 | 17.4 | 95 | 1,046 | 6.1 | 30 |
| 1,221 | 26.1 | 155 | 1,130 | 16.5 | 90 | 1,039 | 5.2 | 25 |
| 1,214 | 25.4 | 150 | 1,123 | 15.7 | 85 | 1,032 | 4.3 | 20 |
| 1,207 | 24.7 | 145 | 1,116 | 15.0 | 80 | 1,025 | 3.4 | 15 |
| 1,200 | 24.0 | 140 | 1,109 | 14.1 | 75 | 1,018 | 2.4 | 10 |
| 1,193 | 23.3 | 135 | 1,102 | 13.2 | 70 | 1,010 | 1.4 | 5 |
| 1,186 | 22.6 | 130 | 1,095 | 12.4 | 65 | | | |

Basic Sulphate of Iron, commercially known as **Nitrate of Iron**, is put upon the market as a dark brown liquid of 91° Tw., and is obtained by the reaction of nitric acid upon iron vitriol. It serves the same purposes as pyrolignite of iron.

Potassium Ferrocyanide or Yellow Prussiate, $K_4FeCy_6 + 3H_2O$, mol. weight 422. (soluble in 3 parts of cold and 1 part of hot water), forms lemon-coloured monoclinic tablets. It is used as a carrier of oxygen in printing and padding with steam Aniline Black, and as an addition to oxidizing discharges, also as a mordant for steam Alizarine Violet.

Sodium Ferrocyanide, $Na_4FeCy_6 + 10H_2O$, mol. weight 484.4, forms yellow monoclinic crystals, and is used instead of Potassium Ferrocyanide on account of its better solubility and cheaper price.

Potassium Ferrocyanide or Red Prussiate, K_4FeCy_6 , mol. weight 329 (soluble in $2\frac{1}{2}$ parts of cold and $1\frac{1}{2}$ parts of hot water), forms dark red rhombic prisms. It is used, like yellow prussiate as a carrier of oxygen, and, aftertreated with caustic soda, for Indigo discharges.

12. Zinc and Cadmium Compounds.

Zinc Dust is put upon the market as a finely divided grey powder, consisting of metallic zinc and some oxide of zinc; it

is a strong reducing agent, and is largely used for setting Indigo vats, so 1 p. n. g. hydrosulphite, bisulphite zinc dust discharges etc.

Zinc Oxide or Zinc White, ZnO , Mol. weight 81, is put upon the market as a white powder, and is employed as a resist for Aniline Black. It serves also for the production of damask printing effects. When used in printing colours it must be ground exceptionally fine.

Sulphate of Zinc, $\text{ZnSO}_4 + 7\text{H}_2\text{O}$, mol. weight 287 (soluble in 1 part of cold and $\frac{1}{6}$ part of hot water), is put upon the market in white crystals, which are very efflorescent. It is used as a mordant for Alizarine Blue S, for aftertreating Melanogen Blue etc.

Specific Gravity of Solutions of Sulphate of Zinc at 59° F.
(Gerlach).

| Spec. Grav. | De-grees Bé | Per cent ZnSO_4 | Percent $\text{ZnSO}_4 + 7\text{H}_2\text{O}$ | Spec. Grav. | De-grees Bé | Per cent ZnSO_4 | Percent $\text{ZnSO}_4 + 7\text{H}_2\text{O}$ |
|-------------|-------------|--------------------------|---|-------------|-------------|--------------------------|---|
| 1.0288 | 3,8 | 2,805 | 5 | 1,2315 | 27,0 | 19,637 | 35 |
| 1,0593 | 8,0 | 5,611 | 10 | 1,2709 | 30,7 | 22,443 | 40 |
| 1,0905 | 12,0 | 8,416 | 15 | 1,3100 | 34,2 | 25,248 | 45 |
| 1,1236 | 17,2 | 11,220 | 20 | 1,3532 | 37,6 | 28,054 | 50 |
| 1,1574 | 19,5 | 14,027 | 25 | 1,3986 | 41,0 | 30,859 | 55 |
| 1,1935 | 23,3 | 16,832 | 30 | 1,4451 | 44,4 | 33,664 | 60 |

Zinc Chromate, $\text{Zn CrO}_4 \cdot \text{ZnO} + 2\text{H}_2\text{O}$, mol. weight 298, is obtained by precipitating the hot solution of Sulphate of Zinc with Potassium or Sodium Chromate. It is used for the production of pulp resists for Indigo. The 50% paste is prepared as follows:

{ 200 g Potassium Chromate
 { 400 g Water
 { 290 g Sulphate of Zinc
 { 300 g Water

precipitated hot, filtered, and pressed to 360 grs.

Zinc Acetate or Acetate of Zinc, $\text{Zn}(\text{CH}_3\text{COO})_2 + 3\text{H}_2\text{O}$, mol. weight 237, forms crystals which are easily soluble in water. It serves as a resist for Aniline Black and as a mordant for Alizarine Blue S etc.

Zinc Sulphide, ZnS , mol. weight 97, is put upon the market mixed with Barium Sulphate, under the name of Lithopone, and is used as an addition to Hydrosulphite white discharges on raised goods.

Zinc Bisulphite, $\text{Zn}(\text{HSO}_3)_2$, mol. weight 227,5 is put upon the market as a yellowish liquid of $32\frac{1}{2}$ Tw., and is used as a mordant for Alizarine Blue.

Sulphate of Cadmium, $\text{CdSO}_4 + 2,66\text{H}_2\text{O}$, mol. weight 256,4 forms white crystals which are efflorescent. It is used for after-treating Melanogen Blue.

Nitrate of Cadmium, $\text{Cd}(\text{NO}_3)_2 + 4\text{H}_2\text{O}$, mol. weight 307,3, is obtained by dissolving metallic cadmium in nitric acid, and forms an easily soluble deliquescent salt. It serves for the production of cadmium sulphide, which latter is used as a steam colour. Nitrate of Cadmium is also used as an addition to Chrome Yellow printing colours in order to prevent darkening through the action of sulphuretted hydrogen when it forms sulphide of cadmium.

Fixing Salt M is a mixture of cadmium sulphate, sulphate of zinc and alum, which is also used for aftertreating Melanogen Blue.

13. Nickel Compounds.

Sulphate of Nickel, $\text{NiSO}_4 + 7\text{H}_2\text{O}$, mol. weight 281, is put upon the market in green, easily soluble crystals and is used for the preparation of various nickel mordants.

Nickel Bisulphite is put upon the market as a green solution of $32\frac{1}{2}$ Tw. and is used as a mordant instead of Acetate of Nickel.

Nickel Acetate or **Acetate of Nickel**, $\text{Ni}(\text{CH}_3\text{COO})_2 + 3\text{H}_2\text{O}$, mol. weight 176,8, is obtained by the double decomposition of nickel sulphate and lead acetate. It is used as a mordant for Alizarine Blue S.

14. Manganese Compounds.

Potassium Permanganate, KMnO_4 , mol. weight 153 (soluble in 15 parts of cold water, and very easily soluble in hot water), forms dark violet, nearly black crystals with a steel blue lustre. It is a strong oxidizer in acid, alkaline and neutral solutions.

Manganous Chloride, $\text{MnCl}_2 + 4\text{H}_2\text{O}$, mol. weight 198, is put upon the market as deliquescent rose coloured crystals or as a solution of 72° Tw. It is used for the production of manganese bistre.

Manganese Sulphate, MnSO_4 , mol. weight 151, is put upon the market in rose coloured crystals containing varying amounts of water, and is used for the production of manganese bistre.

15. Lead Compounds.

Nitrate of Lead, $\text{Pb}(\text{NO}_3)_2$, mol. weight 330, (soluble in 2 parts of cold and 1 part of hot water), forms white crystals, and is used for the preparation of nitrate mordants.

Acetate of Lead or **Sugar of Lead**, $\text{Pb}(\text{CH}_3\text{COO})_2 + 3\text{H}_2\text{O}$, mol. weight 379 (soluble in $1\frac{1}{2}$ parts of cold and $\frac{1}{2}$ part of hot water), is put upon the market in white crystals, and is used for the preparation of acetate mordants.

Specific Gravity of Solutions of Sugar of Lead at 68° F.
(F. Salomon).

| Grammes in 100 cc | Spec. Grav. | Grammes in 100 cc | Spec. Grav. | Grammes in 100 cc | Spec. Grav. |
|----------------------|----------------|----------------------|----------------|----------------------|----------------|
| 1 | 1.0062 | 18 | 1.1118 | 35 | 1.2142 |
| 2 | 1.0124 | 19 | 1.1180 | 36 | 1.2201 |
| 3 | 1.0186 | 20 | 1.1242 | 37 | 1.2261 |
| 4 | 1.0248 | 21 | 1.1302 | 38 | 1.2320 |
| 5 | 1.0311 | 22 | 1.1362 | 39 | 1.2380 |
| 6 | 1.0373 | 23 | 1.1422 | 40 | 1.2440 |
| 7 | 1.0435 | 24 | 1.1482 | 41 | 1.2499 |
| 8 | 1.0497 | 25 | 1.1543 | 42 | 1.2558 |
| 9 | 1.0559 | 26 | 1.1603 | 43 | 1.2617 |
| 10 | 1.0622 | 27 | 1.1663 | 44 | 1.2676 |
| 11 | 1.0684 | 28 | 1.1723 | 45 | 1.2735 |
| 12 | 1.0746 | 29 | 1.1783 | 46 | 1.2794 |
| 13 | 1.0808 | 30 | 1.1844 | 47 | 1.2853 |
| 14 | 1.0870 | 31 | 1.1903 | 48 | 1.2912 |
| 15 | 1.0932 | 32 | 1.1963 | 49 | 1.2981 |
| 16 | 1.0994 | 33 | 1.2022 | 50 | 1.3030 |
| 17 | 1.1056 | 34 | 1.2082 | | |

Basic acetate of lead, is obtained by boiling solutions of sugar of lead with lead oxide. It is used for the preparation of Chrome Orange.

Lead Sulphate or Sulphate of Lead, PbSO_4 , mol. weight 302, is put upon the market as a white paste, and is used as an addition to resists under Indigo Blue.

16. Tungsten Compounds.

Tungstate of Soda, $\text{Na}_2\text{WO}_4 + 2\text{H}_2\text{O}$, mol. weight 330 (soluble in 4 parts of water), is put upon the market in white rhombic tablets. It is used in finishing, to render the goods non-inflammable. Further, it is used for the production of opal effects by printing and afterwards passing through Barium Chloride solutions. It has also been used for fixing insoluble azo colours produced on the fibre.

17. Copper Compounds.

Chloride of Copper, $\text{CuCl}_2 + 2\text{H}_2\text{O}$, mol. weight 170, is a very powerful carrier of oxygen, and is used for Aniline and Diphenyl Black discharges.

Sulphide of Copper, CuS , mol weight 95.5, is used as a carrier of oxygen for colours produced upon the fibre by oxidation.

It is prepared as follows:

- { 3750 parts Copper Vitriol, dissolved in
- { 15000 parts Water,
- { 3900 parts Sodium Sulphide crystals dissolved in
- { 10000 parts Water.

Both solutions are mixed simultaneously with about 20000 parts of cold water; then the precipitate is filtered, washed and pressed until 5400 parts paste are obtained.

Or:

- { 500 parts Sulphur
- { 3500 parts Caustic Soda $66\frac{1}{2}^{\circ}$ Tw.
- { 2000 parts Sulphate of Copper
- { 8000 parts Water

are precipitated hot, decanted twice, washed and pressed to 2500 parts = 30% paste.

When exposed to air or heat for some time, copper sulphide changes into copper sulphate. For that reason it should be kept covered with a wet cloth.

Sulphate of Copper or Bluestone, $\text{CuSO}_4 + 5\text{H}_2\text{O}$, mol. weight 249, (soluble in $2\frac{1}{2}$ parts of cold and $\frac{1}{2}$ part of hot water), is put upon the market in beautiful blue triclinic crystals, and is chiefly used for aftertreating colours in order to make them faster to light.

Specific Gravity of Solutions of Copper Sulphate
at 63° F.

| Spec. Grav. | Per cent $\text{CuSO}_4 + 5\text{H}_2\text{O}$ | Spec. Grav. | Per cent $\text{CuSO}_4 + 5\text{H}_2\text{O}$ |
|----------------|---|----------------|---|
| 1.0126 | 2 | 1.0933 | 14 |
| 1.0254 | 4 | 1.1063 | 16 |
| 1.0384 | 6 | 1.1208 | 18 |
| 1.0516 | 8 | 1.1354 | 20 |
| 1.0649 | 10 | 1.1501 | 22 |
| 1.0785 | 12 | 1.1659 | 24 |

Copper Nitrate or Nitrate of Copper, $\text{Cu}(\text{NO}_3)_2 + 6\text{H}_2\text{O}$, mol. weight 295.5, is put upon the market in blue, easily soluble prisms, and is used as an addition to resists in Indigo discharge printing.

Copper Acetate or Acetate of Copper, $\text{Cu}(\text{CH}_3\text{COO})_2 + \text{H}_2\text{O}$, mol. weight 199, forms blueish green crystals. It is produced by the double decomposition of Copper Sulphate and Lead Acetate, and is used as an addition to the resist pulp in Indigo discharge printing.

Fehling's Solution is used in bleaching as a test for oxycellulose. It is prepared from solutions of sulphate of copper and Seignette salt.

| Copper Sulphate Solution | Seignette Salt Solution |
|---|--|
| 69.278 g Copper Sulphate dissolved in water and made up to 1 litre. | 173 g Seignette salt dissolved in 400 cc Water and made up to 500 cc with 100 cc Caustic Soda (516 parts NaOH per 1000 parts). |

Equal portions of both solutions are mixed before use.

In testing bleached cotton, for oxycellulose, a sample is boiled with 10% of the newly prepared solution on the water bath. A pink tint caused by precipitated cuprous oxide indicates the presence of oxycellulose.

18. Antimony Compounds.

Oxide of Antimony, Sb_2O_3 , mol. weight 287, is put upon the market as a white powder; it is dissolved in glycerine and caustic soda and is used as an addition to the Beta Naphthol prepare, in order to prevent the naphtholated material from turning brown.

In the following table we give a list of the most important salts of antimony, according to W. S. Williams.

| Name | Formula | Percentage of Antimony Oxide (Sb_2O_3) | |
|---|---|--|--------|
| | | theoretical | actual |
| Double Fluoride of Antimony (Antimony Salt 75%) | $\text{NaFl} \cdot x\text{SbFl}_3$ | 75,0 | 73,0 |
| Tartar Emetic | $\text{K}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6 + \frac{1}{2}\text{H}_2\text{O}$ | 43,4 | 42,75 |
| Tartrate of Antimony and Sodium | $\text{Na}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6 + \frac{1}{2}\text{H}_2\text{O}$ | 45,6 | 44,4 |
| Antimony Salt pat. (Froehch) | $\text{SbFl}_3\text{Na}_5(\text{SbO})(\text{C}_2\text{O}_4)_2 + x\text{H}_2\text{O}$ | 41,0 | 37,1 |
| Lactate of Antimony | Acid Lactate of Antimony and Sodium | — | 13,0 |
| Lactate of Antimony liquid | do. | — | 12,5 |
| Antimonine | $[(\text{SbO})(\text{C}_3\text{H}_5\text{O}_3)]_2\text{Ca}_3(\text{C}_3\text{H}_5\text{O}_3)_4 2\text{C}_3\text{H}_5\text{O}_3$ | 26,2 | 13,0 |
| Oxalate of Antimony and Potassium | $(\text{Sb}(\text{C}_2\text{O}_4\text{K})_2 + 6\text{H}_2\text{O})$ | 23,7 | 23,6 |
| Trichloride of Antimony | SbCl_3 | 63,6 | — |
| Trifluoride of Antimony | SbFl_3 | 80,3 | — |
| Antimony Salt (de Haen) | $\text{SbFl}_3(\text{AzH}_4)_2\text{SO}_4$ | 47,0 | — |
| Double Fluoride of Antimony (Antimony Salt 60%) | $\text{SbFl}_3 \cdot \text{NaFl}$ | 66,0 | 64,8 |

Potassium Antimony Tartrate or **Tartar Emetic**, $K(SbO)C_4H_4O_6 + \frac{1}{2}H_2O$, mol. weight 332, (soluble in 15 parts of cold and 2 parts of hot water), is put upon the market in rhombic octahedra, and contains about 43% oxide of antimony. The percentage is determined by titration with Iodine.

It is used in dyeing with basic colours for fixing the tannin, with which it combines forming an insoluble lake. In fixing with tartar emetic or other antimony salts, it is necessary to add to the fixing bath some chalk or soda, in order to neutralize the liberated acid. The fixing baths must not be used for too long a time.

Specific Gravity of Solutions of Tartar Emetic at 63° F.
(Streit).

| Spec. Grav. | Per cent Tartar Emetic | Spec. Grav. | Per cent Tartar Emetic | Spec. Grav. | Per cent Tartar Emetic |
|----------------|------------------------------|----------------|------------------------------|----------------|------------------------------|
| 1,005 | 0,5 | 1,015 | 2,5 | 1,031 | 4,5 |
| 1,007 | 1,0 | 1,018 | 3,0 | 1,035 | 5,0 |
| 1,009 | 1,5 | 1,022 | 3,5 | 1,038 | 5,5 |
| 1,012 | 2,0 | 1,027 | 4,0 | 1,044 | 6,0 |

Sodium Tartar Emetic, $Na(SbO.C_4H_4O_6 + \frac{1}{2}H_2O)$, mol. weight 316, is put upon the market in crystals, and is much more easily soluble than the corresponding potassium salt. It is therefore used for the preparation of concentrated tartar emetic resists.

Potassium Antimony Oxalate, $K_3Sb(C_2O_4)_3 + 4H_2O$, mol. weight 610, serves as a substitute for tartar emetic. It contains only about 25% Sb_2O_3 , nevertheless, in fixing, 10 parts of potassium antimony oxalate are equivalent to 10 parts tartar emetic, because this salt dissociates more easily, and the bath does not become as acid with continued use as when tartar emetic is employed.

Sodium Antimony Fluoride, $SbF_3 \cdot NaF$, mol. weight 219, is put upon the market in triclinic prisms, and is very soluble. It contains about 66% Sb_2O_3 . 6.6 parts of this salt are equivalent to 10 parts tartar emetic.

Antimony Salt, $SbF_3(NH_4)SO_4$, mol. weight 309, forms white, easily soluble crystals, and contains about 47% Sb_2O_3 . 9 parts of antimony salt are equivalent to 10 parts tartar emetic.

Lactate of Antimony or **Antimonine** is put upon the market as a yellowish moist substance; it contains only about 15% Sb_2O_3 . In fixing, 10 parts antimonine can be substituted for 10 parts tartar emetic, as the baths exhaust completely. It is used with the addition of some acetic acid.

19. Tin Compounds.

Stannous Hydrate, $Sn(OH)_2$, mol. weight 152, is obtained by precipitating tin salts with soda.

Stannous Hydrate Paste 23%.

- I. { 695 parts Tin Salts
 10000 parts Water
 II. { 475 parts Soda
 10000 parts Water.

II is slowly mixed into I whilst being stirred, then left to stand, decanted, filtered, and diluted to 2000 parts.

Stannate of Soda is obtained by carefully dissolving stannous hydrate in soda lye at a moderate temperature, and is used in discharging Turkey Red.

Stannic Hydrate, $\text{SnO}(\text{OH})_2$, mol. weight 168, is obtained by precipitating tetrachloride of tin with soda.

Stannic Hydrate 17%.

- 2 lbs. I. { 1000 parts Solid Tetrachloride of Tin 66%, SnCl_4
 5 gall. { 25000 parts Water
 3 lbs. 10 1/2 oz. II. { 1830 parts Soda crystals
 5 gall. { 25000 parts Water

II is gradually added to I, allowed to settle, washed and filtered. The precipitate should weigh 5 1/2 lbs. (25,000 parts.) It is used for the production of oxalate of tin, and as an auxiliary mordant for Alizarine Red steam colours

Stannous Chloride or Tin Crystals, $\text{SnCl}_2 + 2\text{H}_2\text{O}$, mol. weight 225, is put upon the market in crystals. Being hygroscopic, it must be kept in well closed vessels. It dissolves well in little water, whereas an excess of water causes a hydrolytic separation, for which reason tin salt solutions must be acidified. Tin salts are used for the preparation of various tin mordants.

Specific Gravity of Solutions of Tin Salts at 59° F.
 (Gerlach).

| Spec. Grav. | Per cent SnCl_2 + $2\text{H}_2\text{O}$ | Spec. Grav. | Per cent SnCl_2 + $2\text{H}_2\text{O}$ | Spec. Grav. | Per cent SnCl_2 + $2\text{H}_2\text{O}$ |
|----------------|--|----------------|--|----------------|--|
| 1,013 | 2 | 1,212 | 28 | 1,497 | 54 |
| 1,026 | 4 | 1,230 | 30 | 1,525 | 56 |
| 1,040 | 6 | 1,249 | 32 | 1,554 | 58 |
| 1,054 | 8 | 1,268 | 34 | 1,582 | 60 |
| 1,068 | 10 | 1,288 | 36 | 1,613 | 62 |
| 1,083 | 12 | 1,309 | 38 | 1,644 | 64 |
| 1,097 | 14 | 1,330 | 40 | 1,677 | 66 |
| 1,113 | 16 | 1,352 | 42 | 1,711 | 68 |
| 1,128 | 18 | 1,374 | 44 | 1,745 | 70 |
| 1,144 | 20 | 1,397 | 46 | 1,783 | 72 |
| 1,161 | 22 | 1,421 | 40 | 1,821 | 74 |
| 1,177 | 24 | 1,445 | 50 | 1,840 | 75 |
| 1,194 | 26 | 1,471 | 52 | | |

Tin Oxalate or Oxalate of Tin, $\text{Sn}(\text{C}_2\text{O}_4)_2$, mol. weight 294, is obtained by dissolving stannous hydrate in oxalic acid.

Oxalate of Tin 25° Tw.

1000 parts Stannous Hydrate paste 23% are heated on the water bath with

40 parts Oxalic Acid, and reduced with water to 25° Tw.

The hydrate must not dissolve completely. Oxalate of Tin is used as auxiliary mordant for Alizarine Red steam colours.

Tetrachloride of Tin, SnCl_4 , mol. weight 260, is put upon the market in solid lumps and in solution of 106° Tw. It is used for the production of stannic hydrate by precipitation with soda.

Nitro-Hydrochloride of Tin 106° Tw. is obtained from tin crystals and nitric acid

1000 parts Tin crystals are mixed in small portions with

1000 parts Nitric Acid 62° Tw.,

and the solution is heated on the water bath, in order to drive off the nitrous vapours. The liquid is then diluted with water to 106° Tw. It is used as an auxiliary mordant for Alizarine Red steam colours.

Specific Gravity of Solutions of Nitro-Hydrochloride of Tin at 59° F.

| Spec. Grav. | De- grees Bé | grs Sn per litre | Spec. Grav. | De- grees Bé | grs Sn per litre | Spec. Grav. | De- grees Bé | grs Sn per litre |
|----------------|--------------------|------------------------|----------------|--------------------|------------------------|----------------|--------------------|------------------------|
| 1,024 | 3,3 | 10 | 1,222 | 26,2 | 100 | 1,420 | 42,7 | 190 |
| 1,046 | 6,2 | 20 | 1,244 | 28,3 | 110 | 1,442 | 44,3 | 200 |
| 1,068 | 9,1 | 30 | 1,266 | 30,3 | 120 | 1,464 | 45,7 | 210 |
| 1,090 | 11,9 | 40 | 1,288 | 32,3 | 130 | 1,486 | 47,2 | 220 |
| 1,112 | 14,4 | 50 | 1,310 | 34,2 | 140 | 1,508 | 48,5 | 230 |
| 1,134 | 17,0 | 60 | 1,332 | 36,0 | 150 | 1,530 | 50,0 | 240 |
| 1,156 | 19,4 | 70 | 1,354 | 37,7 | 160 | 1,552 | 51,4 | 250 |
| 1,178 | 21,7 | 80 | 1,376 | 39,6 | 170 | 1,562 | 51,9 | 254,7 |
| 1,200 | 24,0 | 90 | 1,398 | 41,1 | 180 | | | |

Tin Acetate or Acetate of Tin, $\text{Sn}(\text{CH}_3\text{COO})_2$, mol. weight 236, is obtained either by dissolving stannous oxide in glacial acetic acid or by the double decomposition of tin salts and sugar of lead.

Acetate of Tin 32 1/2° Tw.

{ 1000 parts Tin Salts are dissolved hot with

{ 800 parts Acetic Acid 9° Tw.

{ 1000 parts Sugar of Lead are dissolved hot with

{ 800 parts Acetic Acid 9° Tw.

The tin salts solution is mixed into the sugar of lead solution, left to cool, filtered, and diluted with acetic acid to 32 1/2° Tw. Its chief use is as a discharge for direct dyeing colours.

Specific Gravity of Solutions of Acetate of Tin
at 59° F.

| Spec. Grav. | Degrees Bé | grs Sn per litre | Spec. Grav. | Degrees Bé | grs Sn per litre |
|----------------|---------------|------------------------|----------------|---------------|------------------------|
| 1,018 | 2.5 | 5 | 1,115 | 14.9 | 70 |
| 1,025 | 3.4 | 10 | 1,123 | 15.8 | 75 |
| 1,033 | 4.4 | 15 | 1,130 | 16.6 | 80 |
| 1,040 | 5.4 | 20 | 1,137 | 17.4 | 85 |
| 1,048 | 6.4 | 25 | 1,145 | 18.3 | 90 |
| 1,055 | 7.4 | 30 | 1,153 | 19.1 | 95 |
| 1,063 | 8.4 | 35 | 1,160 | 19.8 | 100 |
| 1,070 | 9.4 | 40 | 1,167 | 20.6 | 105 |
| 1,077 | 10.3 | 45 | 1,175 | 21.4 | 110 |
| 1,085 | 11.2 | 50 | 1,183 | 22.3 | 115 |
| 1,093 | 12.1 | 55 | 1,190 | 23.0 | 120 |
| 1,100 | 13.0 | 60 | 1,192 | 23.2 | 121.5 |
| 1,107 | 13.9 | 65 | | | |

20. Vanadium and Cerium Compounds.

Vanadate of Ammonia NH_4VO_3 , mol. weight 172, is put upon the market as a yellowish white powder; it is used for the preparation of vanadium chloride, and as a carrier of oxygen.

Vanadium Chloride, VCl_3 , mol. weight 122, is used as a solution (1:1000) in printing with Aniline Oxidation Black. It can be prepared in the following manner:

10 g vanadate of ammonia are dissolved in 100 cc muriatic acid $34\frac{1}{2}^\circ$ Tw. and 400 cc water; to this solution are added 5 g glycerine, and the whole heated until the yellowish green fluid has turned blue. The whole is diluted to 10 litres. The reduction is accelerated by adding sodium bisulphite. For 10 g ammonium metavanadate 30 cc bisulphite $71\frac{1}{2}^\circ$ Tw. are required.

Cerochloride, CeCl_3 , mol. weight 246, is put upon the market as a 20% solution, and is used as a carrier of oxygen in printing with Diphenyl Black.

21. Acids.

Hydrochloric Acid, Muriatic Acid, HCl , mol. weight 36.4, is put upon the market as a solution of $28\frac{1}{2}$ — 38° Tw. The percentage can be found direct from the specific gravity or by titration. It is extensively used in bleaching etc. 97.3 cc or 113.2 g hydrochloric acid $32\frac{1}{2}^\circ$ Tw. contain 1 g mol, HCl .

Specific Gravity of Hydrochloric Acid.
(Lunge and Marchlewski).

| Spec. Grav. at 59° F. 39° F. (Vacuum) | De- grees Bé | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | | 1 litre contains kos. | |
|---|--------------------|--------------------|---|----------------|--------------------------|----------------|
| | | | Per cent HCl | Acid 20° Bé | HCl | Acid 20° Bé |
| 1,000 | 0,0 | 0,0 | 0,16 | 0,49 | 0,0016 | 0,0049 |
| 1,005 | 0,7 | 1 | 1,15 | 3,58 | 0,012 | 0,036 |
| 1,010 | 1,4 | 2 | 2,14 | 6,66 | 0,022 | 0,067 |
| 1,015 | 2,1 | 3 | 3,12 | 9,71 | 0,032 | 0,099 |
| 1,020 | 2,7 | 4 | 4,13 | 12,86 | 0,042 | 0,131 |
| 1,025 | 3,4 | 5 | 5,15 | 16,04 | 0,053 | 0,164 |
| 1,030 | 4,1 | 6 | 6,15 | 19,16 | 0,064 | 0,197 |
| 1,035 | 4,7 | 7 | 7,15 | 22,27 | 0,074 | 0,231 |
| 1,040 | 5,4 | 8 | 8,16 | 25,42 | 0,085 | 0,264 |
| 1,045 | 6,0 | 9 | 9,16 | 28,53 | 0,096 | 0,298 |
| 1,050 | 6,7 | 10 | 10,17 | 31,68 | 0,107 | 0,333 |
| 1,055 | 7,4 | 11 | 11,18 | 34,82 | 0,118 | 0,367 |
| 1,060 | 8,0 | 12 | 12,19 | 37,97 | 0,129 | 0,403 |
| 1,065 | 8,7 | 13 | 13,19 | 41,09 | 0,141 | 0,438 |
| 1,070 | 9,4 | 14 | 14,17 | 44,14 | 0,152 | 0,472 |
| 1,075 | 10,0 | 15 | 15,16 | 47,22 | 0,163 | 0,508 |
| 1,080 | 10,6 | 16 | 16,15 | 50,31 | 0,174 | 0,543 |
| 1,085 | 11,2 | 17 | 17,13 | 53,36 | 0,186 | 0,579 |
| 1,090 | 11,9 | 18 | 18,11 | 56,41 | 0,197 | 0,615 |
| 1,095 | 12,4 | 19 | 19,06 | 59,37 | 0,209 | 0,650 |
| 1,100 | 13,0 | 20 | 20,01 | 62,33 | 0,220 | 0,686 |
| 1,105 | 13,6 | 21 | 20,97 | 65,32 | 0,232 | 0,722 |
| 1,110 | 14,2 | 22 | 21,92 | 68,28 | 0,243 | 0,758 |
| 1,115 | 14,9 | 23 | 22,86 | 71,21 | 0,255 | 0,794 |
| 1,120 | 15,4 | 24 | 23,82 | 74,20 | 0,267 | 0,831 |
| 1,125 | 16,0 | 25 | 24,78 | 77,19 | 0,278 | 0,868 |
| 1,130 | 16,5 | 26 | 25,75 | 80,21 | 0,291 | 0,906 |
| 1,135 | 17,1 | 27 | 26,70 | 83,18 | 0,303 | 0,944 |
| 1,140 | 17,7 | 28 | 27,66 | 86,17 | 0,315 | 0,982 |
| 1,1425 | 18,0 | | 28,14 | 87,66 | 0,322 | 1,002 |
| 1,145 | 18,3 | 29 | 28,61 | 89,13 | 0,328 | 1,021 |
| 1,150 | 18,8 | 30 | 29,57 | 92,11 | 0,340 | 1,059 |
| 1,152 | 19,0 | | 29,95 | 93,30 | 0,345 | 1,075 |
| 1,155 | 19,3 | 31 | 30,55 | 95,17 | 0,353 | 1,099 |
| 1,160 | 19,8 | 32 | 31,52 | 98,19 | 0,366 | 1,139 |
| 1,163 | 20,0 | | 32,10 | 100,00 | 0,373 | 1,163 |
| 1,165 | 20,3 | 33 | 32,49 | 101,21 | 0,379 | 1,179 |
| 1,170 | 20,9 | 34 | 33,46 | 104,24 | 0,392 | 1,220 |
| 1,171 | 21,0 | | 33,65 | 104,82 | 0,394 | 1,227 |
| 1,175 | 21,4 | 35 | 34,42 | 107,22 | 0,404 | 1,260 |
| 1,180 | 22,0 | 36 | 35,39 | 110,24 | 0,418 | 1,301 |
| 1,185 | 22,5 | 37 | 36,31 | 113,11 | 0,430 | 1,340 |
| 1,190 | 22,0 | 38 | 37,23 | 115,98 | 0,443 | 1,380 |
| 1,195 | 22,5 | 39 | 38,16 | 118,87 | 0,456 | 1,421 |
| 1,200 | 22,0 | 40 | 39,11 | 121,84 | 0,469 | 1,462 |

Sulphuric Acid. H_2SO_4 , mol. weight 98, is put upon the market in highly concentrated form as acid of 66° Bé (168° Tw.). Concentrated sulphuric acid forms hydrates with water under generation of heat. Consequently, in diluting concentrated sulphuric acid it must be gradually mixed into an excess of cold water. The percentage of the acid is determined by titration with normal alkali. Sulphuric acid is largely used along with Glauber's salt, as an addition to the dyebath when dyeing acid wool colours, and also finds extensive application in bleaching.

Specific Gravity of Sulphuric Acid.
(Lunge and Isler).

| Spec. Grav. at 59° F. (vacuum) 39° F. | Degrees Bé | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | | Spec. Grav. at 59° F. (vacuum) 39° F. | Degrees Bé | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | |
|---|------------|-----------------|---|---|---|------------|-----------------|---|---|
| | | | P. cent H_2SO_4 | 1 litre contains in chem pure acid kos. H_2SO_4 | | | | P. cent H_2SO_4 | 1 litre contains in chem pure acid kos. H_2SO_4 |
| 1.000 | 0 | 0 | 0.09 | 0.001 | 1.145 | 18.3 | 29 | 20.26 | 0.231 |
| 1.005 | 0.7 | 1 | 0.83 | 0.008 | 1.150 | 18.8 | 30 | 20.91 | 0.239 |
| 1.010 | 1.4 | 2 | 1.57 | 0.016 | 1.155 | 19.3 | 31 | 21.55 | 0.248 |
| 1.015 | 2.1 | 3 | 2.30 | 0.023 | 1.160 | 19.8 | 32 | 22.19 | 0.257 |
| 1.020 | 2.7 | 4 | 3.03 | 0.031 | 1.165 | 20.3 | 33 | 22.83 | 0.266 |
| 1.025 | 3.4 | 5 | 3.76 | 0.039 | 1.170 | 20.9 | 34 | 23.47 | 0.275 |
| 1.030 | 4.1 | 6 | 4.49 | 0.046 | 1.175 | 21.4 | 35 | 24.12 | 0.283 |
| 1.035 | 4.7 | 7 | 5.23 | 0.054 | 1.180 | 22.0 | 36 | 24.76 | 0.292 |
| 1.040 | 5.4 | 8 | 5.96 | 0.062 | 1.185 | 22.5 | 37 | 25.40 | 0.301 |
| 1.045 | 6.0 | 9 | 6.67 | 0.071 | 1.190 | 23.0 | 38 | 26.04 | 0.310 |
| 1.050 | 6.7 | 10 | 7.37 | 0.077 | 1.195 | 23.5 | 39 | 26.68 | 0.319 |
| 1.055 | 7.4 | 11 | 8.07 | 0.085 | 1.200 | 24.0 | 40 | 27.32 | 0.328 |
| 1.060 | 8.0 | 12 | 8.77 | 0.093 | 1.205 | 24.5 | 41 | 27.95 | 0.337 |
| 1.065 | 8.7 | 13 | 9.47 | 0.102 | 1.210 | 25.0 | 42 | 28.58 | 0.346 |
| 1.070 | 9.4 | 14 | 10.19 | 0.109 | 1.215 | 25.5 | 43 | 29.21 | 0.355 |
| 1.075 | 10.0 | 15 | 10.90 | 0.117 | 1.220 | 26.0 | 44 | 29.84 | 0.364 |
| 1.080 | 10.6 | 16 | 11.60 | 0.125 | 1.225 | 26.4 | 45 | 30.48 | 0.373 |
| 1.085 | 11.2 | 17 | 12.30 | 0.133 | 1.230 | 26.9 | 46 | 31.11 | 0.382 |
| 1.090 | 11.9 | 18 | 12.99 | 0.142 | 1.235 | 27.4 | 47 | 31.70 | 0.391 |
| 1.095 | 12.4 | 19 | 13.67 | 0.150 | 1.240 | 27.9 | 48 | 32.28 | 0.400 |
| 1.100 | 13.0 | 20 | 14.35 | 0.158 | 1.245 | 28.4 | 49 | 32.86 | 0.409 |
| 1.105 | 13.6 | 21 | 15.03 | 0.166 | 1.250 | 28.8 | 50 | 33.43 | 0.418 |
| 1.110 | 14.2 | 22 | 15.71 | 0.175 | 1.255 | 29.3 | 51 | 34.00 | 0.426 |
| 1.115 | 14.9 | 23 | 16.36 | 0.183 | 1.260 | 29.7 | 52 | 34.57 | 0.435 |
| 1.120 | 15.4 | 24 | 17.01 | 0.191 | 1.265 | 30.2 | 53 | 35.14 | 0.444 |
| 1.125 | 16.0 | 25 | 17.66 | 0.199 | 1.270 | 30.6 | 54 | 35.71 | 0.454 |
| 1.130 | 16.5 | 26 | 18.31 | 0.207 | 1.275 | 31.1 | 55 | 36.29 | 0.462 |
| 1.135 | 17.1 | 27 | 18.96 | 0.215 | 1.280 | 31.5 | 56 | 36.87 | 0.472 |
| 1.140 | 17.7 | 28 | 19.61 | 0.223 | 1.285 | 32.0 | 57 | 37.45 | 0.481 |

| Spec. Grav. at 59° F. 39° F. | Degrees B \acute{e} | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | | Spec. Grav. at 59° F. 39° F. | Degrees B \acute{e} | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | |
|------------------------------------|-----------------------|-----------------|---|-----------------------|------------------------------------|-----------------------|-----------------|---|------------------------|
| | | | P. cent H $_2$ SO $_4$ | Kos H $_2$ SO $_4$ | | | | P. cent H $_2$ SO $_4$ | Kos. H $_2$ SO $_4$ |
| 1,290 | 32,4 | 58 | 38,68 | 0,490 | 1,495 | 47,8 | 99 | 59,22 | 0,885 |
| 1,295 | 32,8 | 59 | 38,61 | 0,500 | 1,500 | 48,1 | 100 | 59,70 | 0,896 |
| 1,300 | 33,3 | 60 | 39,19 | 0,509 | 1,505 | 48,4 | 101 | 60,18 | 0,906 |
| 1,305 | 33,7 | 61 | 39,77 | 0,519 | 1,510 | 48,7 | 102 | 60,65 | 0,916 |
| 1,310 | 34,2 | 62 | 40,35 | 0,528 | 1,515 | 49,0 | 103 | 61,12 | 0,926 |
| 1,315 | 34,6 | 63 | 40,93 | 0,538 | 1,520 | 49,4 | 104 | 61,59 | 0,936 |
| 1,320 | 35,0 | 64 | 41,50 | 0,548 | 1,525 | 49,7 | 105 | 62,06 | 0,946 |
| 1,325 | 35,4 | 65 | 42,08 | 0,557 | 1,530 | 50,0 | 106 | 62,53 | 0,957 |
| 1,330 | 35,8 | 66 | 42,66 | 0,567 | 1,535 | 50,3 | 107 | 63,00 | 0,967 |
| 1,335 | 36,2 | 67 | 43,20 | 0,577 | 1,540 | 50,6 | 108 | 63,43 | 0,977 |
| 1,340 | 36,6 | 68 | 43,74 | 0,586 | 1,545 | 50,9 | 109 | 63,85 | 0,987 |
| 1,345 | 37,0 | 69 | 44,28 | 0,596 | 1,550 | 51,2 | 110 | 64,26 | 0,996 |
| 1,350 | 37,4 | 70 | 44,82 | 0,605 | 1,555 | 51,5 | 111 | 64,67 | 1,006 |
| 1,355 | 37,8 | 71 | 45,35 | 0,614 | 1,560 | 51,8 | 112 | 65,08 | 1,015 |
| 1,360 | 38,2 | 72 | 45,88 | 0,624 | 1,565 | 52,1 | 113 | 65,49 | 1,025 |
| 1,365 | 38,6 | 73 | 46,41 | 0,633 | 1,570 | 52,4 | 114 | 65,90 | 1,035 |
| 1,370 | 39,0 | 74 | 46,94 | 0,643 | 1,575 | 52,7 | 115 | 66,30 | 1,044 |
| 1,375 | 39,4 | 75 | 47,47 | 0,653 | 1,580 | 53,0 | 116 | 66,71 | 1,054 |
| 1,380 | 39,8 | 76 | 48,00 | 0,662 | 1,585 | 53,3 | 117 | 67,13 | 1,064 |
| 1,385 | 40,1 | 77 | 48,53 | 0,672 | 1,590 | 53,6 | 118 | 67,59 | 1,073 |
| 1,390 | 40,5 | 78 | 49,06 | 0,682 | 1,595 | 53,9 | 119 | 68,05 | 1,085 |
| 1,395 | 40,8 | 79 | 49,59 | 0,692 | 1,600 | 54,1 | 120 | 68,51 | 1,096 |
| 1,400 | 41,2 | 80 | 50,11 | 0,702 | 1,605 | 54,4 | 121 | 68,97 | 1,107 |
| 1,405 | 41,6 | 81 | 50,63 | 0,711 | 1,610 | 54,7 | 122 | 69,43 | 1,118 |
| 1,410 | 42,0 | 82 | 51,15 | 0,721 | 1,615 | 55,0 | 123 | 69,89 | 1,128 |
| 1,415 | 42,3 | 83 | 51,66 | 0,730 | 1,620 | 55,2 | 124 | 70,32 | 1,139 |
| 1,420 | 42,7 | 84 | 52,15 | 0,740 | 1,625 | 55,5 | 125 | 70,74 | 1,150 |
| 1,425 | 43,1 | 85 | 52,63 | 0,750 | 1,630 | 55,8 | 126 | 71,16 | 1,160 |
| 1,430 | 43,4 | 86 | 53,11 | 0,759 | 1,635 | 56,0 | 127 | 71,57 | 1,170 |
| 1,435 | 43,8 | 87 | 53,59 | 0,769 | 1,640 | 56,3 | 128 | 71,99 | 1,181 |
| 1,440 | 44,1 | 88 | 54,07 | 0,779 | 1,645 | 56,6 | 129 | 72,40 | 1,192 |
| 1,445 | 44,4 | 89 | 54,55 | 0,789 | 1,650 | 56,9 | 130 | 72,82 | 1,202 |
| 1,450 | 44,8 | 90 | 55,03 | 0,798 | 1,655 | 57,1 | 131 | 73,23 | 1,212 |
| 1,455 | 45,1 | 91 | 55,50 | 0,808 | 1,660 | 57,4 | 132 | 73,64 | 1,222 |
| 1,460 | 45,4 | 92 | 55,97 | 0,817 | 1,665 | 57,7 | 133 | 74,07 | 1,233 |
| 1,465 | 45,8 | 93 | 56,43 | 0,827 | 1,670 | 57,9 | 134 | 74,51 | 1,244 |
| 1,470 | 46,1 | 94 | 56,90 | 0,837 | 1,675 | 58,2 | 135 | 74,97 | 1,256 |
| 1,475 | 46,4 | 95 | 57,37 | 0,846 | 1,680 | 58,4 | 136 | 75,42 | 1,267 |
| 1,480 | 46,8 | 96 | 57,83 | 0,856 | 1,685 | 58,7 | 137 | 75,86 | 1,278 |
| 1,485 | 47,1 | 97 | 58,28 | 0,865 | 1,690 | 58,9 | 138 | 76,30 | 1,289 |
| 1,490 | 47,4 | 98 | 58,74 | 0,876 | 1,695 | 59,2 | 139 | 76,73 | 1,301 |

| Spec. Grav. at 59° F. (vacuum) 39° F. | Degrees Bé | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | 1 litre contains in chem pure acid | Spec. Grav. at 59° F. (vacuum) 39° F. | Degrees Bé | Degrees Twaddle | 100 parts by weight contain in chemi- cally pure acid | |
|---|------------|-----------------|---|--|---|------------|-----------------|---|--|
| | | | | | | | | P cent H ₂ SO ₄ | kos. H ₂ SO ₄ |
| 1,700 | 59,5 | 140 | 77,17 | 1,312 | 1,820 | 65,0 | 164 | 90,05 | 1,639 |
| 1,705 | 59,7 | 141 | 77,60 | 1,323 | 1,821 | | | 90,20 | 1,643 |
| 1,710 | 60,0 | 142 | 78,04 | 1,334 | 1,822 | 65,1 | | 90,40 | 1,647 |
| 1,715 | 60,2 | 143 | 78,48 | 1,346 | 1,823 | | | 90,60 | 1,651 |
| 1,720 | 60,4 | 144 | 78,92 | 1,357 | 1,824 | 65,2 | | 90,80 | 1,656 |
| 1,725 | 60,6 | 145 | 79,36 | 1,369 | 1,825 | | 165 | 91,00 | 1,661 |
| 1,730 | 60,9 | 146 | 79,80 | 1,381 | 1,826 | 65,3 | | 91,25 | 1,666 |
| 1,735 | 61,1 | 147 | 80,24 | 1,392 | 1,827 | | | 91,50 | 1,671 |
| 1,740 | 61,4 | 148 | 80,68 | 1,404 | 1,828 | 65,4 | | 91,70 | 1,676 |
| 1,745 | 61,6 | 149 | 81,12 | 1,416 | 1,829 | | | 91,90 | 1,681 |
| 1,750 | 61,8 | 150 | 81,56 | 1,427 | 1,830 | | 166 | 92,10 | 1,685 |
| 1,755 | 62,1 | 151 | 82,00 | 1,439 | 1,831 | 65,5 | | 92,30 | 1,690 |
| 1,760 | 62,3 | 152 | 82,44 | 1,451 | 1,832 | | | 92,52 | 1,695 |
| 1,765 | 62,5 | 153 | 82,88 | 1,463 | 1,833 | 65,6 | | 92,75 | 1,700 |
| 1,770 | 62,8 | 154 | 83,32 | 1,475 | 1,834 | | | 93,05 | 1,706 |
| 1,775 | 63,0 | 155 | 83,90 | 1,489 | 1,835 | 65,7 | 167 | 93,43 | 1,713 |
| 1,780 | 63,2 | 156 | 84,50 | 1,504 | 1,836 | | | 93,80 | 1,722 |
| 1,785 | 63,5 | 157 | 85,10 | 1,519 | 1,837 | | | 94,20 | 1,730 |
| 1,790 | 63,7 | 158 | 85,70 | 1,534 | 1,838 | 65,8 | | 94,60 | 1,739 |
| 1,795 | 64,0 | 159 | 86,30 | 1,549 | 1,839 | | | 95,00 | 1,748 |
| 1,800 | 64,2 | 160 | 86,90 | 1,564 | 1,840 | 65,9 | 168 | 95,60 | 1,759 |
| 1,805 | 64,4 | 161 | 87,60 | 1,581 | 1,8405 | | | 95,95 | 1,765 |
| 1,810 | 64,6 | 162 | 88,30 | 1,598 | 1,841 | | | 97,00 | 1,786 |
| 1,815 | 64,8 | 163 | 89,05 | 1,621 | 1,8415 | | | 97,70 | 1,799 |

Sulphur S, atomic weight 32, is put upon the market in sticks and as so-called "flowers of sulphur". The latter always contain sulphurous acid. Sulphur is used in the bleaching of wool, straw, and other substances, when it is burnt is sulphur dioxide produced.

Sulphur Dioxide, SO₂, mol. weight 64, is used as a gas and also as an aqueous solution for the bleaching of wool, silk, straw etc.

Specific Gravity of the Aqueous Solution of Sulphur Dioxide at 59° F.

(Scott).

| Specific Gravity | Per cent SO ₂ | Specific Gravity | Per cent SO ₂ |
|------------------|--------------------------|------------------|--------------------------|
| 1,0028 | 0,5 | 1,0302 | 5,5 |
| 1,0056 | 1,0 | 1,0328 | 6,0 |
| 1,0085 | 1,5 | 1,0353 | 6,5 |
| 1,0113 | 2,0 | 1,0377 | 7,0 |
| 1,0141 | 2,5 | 1,0401 | 7,5 |
| 1,0168 | 3,0 | 1,0426 | 8,0 |
| 1,0194 | 3,5 | 1,0450 | 8,5 |
| 1,0221 | 4,0 | 1,0474 | 9,0 |
| 1,0248 | 4,5 | 1,0497 | 9,5 |
| 1,0275 | 5,0 | 1,0520 | 10,0 |

Formic acid, HCOOH, mol. weight 46, boiling point 210° F., has partly replaced acetic acid owing to its lower price. It is put upon the market as a liquid of 80-96% and has a pungent smell. Formic acid is used for the preparation of various mordants, and in wool dyeing can be advantageously employed instead of acetic acid. It is more volatile than acetic acid, and is one of the strongest organic acids.

Specific Gravity of Formic Acid at 68° F. compared with Water at 39° F.

(Richardson and Allaire).

| Spec. Grav. | Weight Per cent CH ₂ O ₂ | Volume Per cent CH ₂ O ₂ | Spec. Grav. | Weight Per cent CH ₂ O ₂ | Volume Per cent CH ₂ O ₂ | Spec. Grav. | Weight Per cent CH ₂ O ₂ | Volume Per cent CH ₂ O ₂ |
|-------------|--|--|-------------|--|--|-------------|--|--|
| 0,9983 | 0 | 0,00 | 1,0247 | 10 | 8,40 | 1,1425 | 60 | 56,13 |
| 1,0020 | 1 | 0,82 | 1,0371 | 15 | 12,80 | 1,1544 | 65 | 61,44 |
| 1,0041 | 2 | 1,64 | 1,0489 | 20 | 17,17 | 1,1656 | 70 | 66,80 |
| 1,0071 | 3 | 2,48 | 1,0610 | 25 | 21,73 | 1,1770 | 75 | 72,27 |
| 1,0094 | 4 | 3,30 | 1,0730 | 30 | 26,37 | 1,1861 | 80 | 77,67 |
| 1,0116 | 5 | 4,14 | 1,0848 | 35 | 31,10 | 1,1954 | 85 | 83,19 |
| 1,0142 | 6 | 4,98 | 1,0964 | 40 | 35,90 | 1,2045 | 90 | 88,74 |
| 1,0171 | 7 | 5,81 | 1,1086 | 45 | 40,82 | 1,2141 | 95 | 94,48 |
| 1,0197 | 8 | 6,68 | 1,1208 | 50 | 45,88 | 1,2213 | 100 | 100,00 |
| 1,0222 | 9 | 7,55 | 1,1321 | 55 | 51,01 | | | |

Nitric acid, HNO_3 , mol. weight 63, is put upon the market as a liquid of 67–77° Tw. and is a very strong acid which dissolves most metals, converting them into nitrates.

Specific Gravity of Nitric Acid.

| Spec. Grav. | De- grees Bé | 100 parts contain at 59° F | | Spec. Grav. | De- grees Bé | 100 parts contain at 59° F | |
|----------------|--------------------|-------------------------------|--------------------------|----------------|--------------------|-------------------------------|--------------------------|
| | | g HNO_3 | g N_2O_5 | | | g HNO_3 | g N_2O_5 |
| 1,000 | 0 | 0,2 | 0,1 | 1,221 | 26 | 35,5 | 30,4 |
| 1,007 | 1 | 1,5 | 1,3 | 1,231 | 27 | 37,0 | 31,7 |
| 1,014 | 2 | 2,6 | 2,2 | 1,242 | 28 | 38,6 | 33,1 |
| 1,022 | 3 | 4,0 | 3,4 | 1,252 | 29 | 40,2 | 34,5 |
| 1,029 | 4 | 5,1 | 4,4 | 1,261 | 30 | 41,5 | 35,6 |
| 1,036 | 5 | 6,3 | 5,4 | 1,275 | 31 | 43,5 | 37,3 |
| 1,044 | 6 | 7,6 | 6,5 | 1,286 | 32 | 45,0 | 38,6 |
| 1,052 | 7 | 9,0 | 7,7 | 1,298 | 33 | 47,1 | 40,4 |
| 1,060 | 8 | 10,2 | 8,7 | 1,309 | 34 | 48,6 | 41,7 |
| 1,067 | 9 | 11,4 | 9,8 | 1,321 | 35 | 50,7 | 43,5 |
| 1,075 | 10 | 12,7 | 10,9 | 1,334 | 36 | 52,9 | 45,3 |
| 1,083 | 11 | 14,0 | 12,0 | 1,346 | 37 | 55,0 | 47,2 |
| 1,091 | 12 | 15,3 | 13,1 | 1,359 | 38 | 57,3 | 49,1 |
| 1,100 | 13 | 16,8 | 14,4 | 1,372 | 39 | 59,6 | 51,1 |
| 1,108 | 14 | 18,0 | 15,4 | 1,384 | 40 | 61,7 | 52,9 |
| 1,116 | 15 | 19,4 | 16,6 | 1,398 | 41 | 64,5 | 55,3 |
| 1,125 | 16 | 20,8 | 17,8 | 1,412 | 42 | 67,5 | 57,9 |
| 1,134 | 17 | 22,2 | 19,0 | 1,426 | 43 | 70,6 | 60,5 |
| 1,143 | 18 | 23,6 | 20,2 | 1,440 | 44 | 74,4 | 63,8 |
| 1,152 | 19 | 24,9 | 21,3 | 1,454 | 45 | 78,4 | 67,2 |
| 1,161 | 20 | 26,3 | 22,5 | 1,470 | 46 | 83,0 | 71,1 |
| 1,171 | 21 | 27,8 | 23,8 | 1,485 | 47 | 87,1 | 74,7 |
| 1,180 | 22 | 29,2 | 25,0 | 1,501 | 48 | 92,8 | 79,4 |
| 1,190 | 23 | 30,7 | 26,3 | 1,516 | 49 | 96,0 | 82,3 |
| 1,199 | 24 | 32,1 | 27,5 | 1,524 | 49,5 | 98,0 | 84,0 |
| 1,210 | 25 | 33,8 | 28,9 | 1,530 | 49,9 | 100,0 | 85,7 |

Acetic acid, CH_3COOH , mol. weight 60, is put upon the market as Glacial Acetic Acid of 100%, or in solutions of 9–12 or more degrees of Tw. It is impossible to determine the exact percentage by specific gravity, and therefore it is advisable to ascertain it by titration with normal alkali. Acetic acid is used as a solvent for dyestuffs, for preventing the lake formation in printing colours, for correcting water etc.

Specific Gravity of Acetic Acid at 59° F.
(Oudemans).

| Spec. Grav. | Per cent | Spec. Grav. | Per cent | Spec. Grav. | Per cent | Spec. Grav. | Per cent |
|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
| 0,9992 | 0 | 1,0363 | 26 | 1,0631 | 52 | 1,0748 | 78 |
| 1,0007 | 1 | 1,0375 | 27 | 1,0638 | 53 | 1,0748 | 79 |
| 1,0022 | 2 | 1,0388 | 28 | 1,0646 | 54 | 1,0748 | 80 |
| 1,0037 | 3 | 1,0400 | 29 | 1,0653 | 55 | 1,0747 | 81 |
| 1,0052 | 4 | 1,0412 | 30 | 1,0660 | 56 | 1,0746 | 82 |
| 1,0067 | 5 | 1,0424 | 31 | 1,0666 | 57 | 1,0744 | 83 |
| 1,0083 | 6 | 1,0436 | 32 | 1,0673 | 58 | 1,0742 | 84 |
| 1,0098 | 7 | 1,0447 | 33 | 1,0679 | 59 | 1,0739 | 85 |
| 1,0113 | 8 | 1,0459 | 34 | 1,0685 | 60 | 1,0736 | 86 |
| 1,0127 | 9 | 1,0470 | 35 | 1,0691 | 61 | 1,0731 | 87 |
| 1,0142 | 10 | 1,0481 | 36 | 1,0697 | 62 | 1,0726 | 88 |
| 1,0157 | 11 | 1,0492 | 37 | 1,0702 | 63 | 1,0720 | 89 |
| 1,0171 | 12 | 1,0502 | 38 | 1,0707 | 64 | 1,0713 | 90 |
| 1,0185 | 13 | 1,0513 | 39 | 1,0712 | 65 | 1,0705 | 91 |
| 1,0200 | 14 | 1,0523 | 40 | 1,0717 | 66 | 1,0696 | 92 |
| 1,0214 | 15 | 1,0533 | 41 | 1,0721 | 67 | 1,0686 | 93 |
| 1,0228 | 16 | 1,0543 | 42 | 1,0725 | 68 | 1,0674 | 94 |
| 1,0242 | 17 | 1,0552 | 43 | 1,0729 | 69 | 1,0660 | 95 |
| 1,0256 | 18 | 1,0562 | 44 | 1,0733 | 70 | 1,0644 | 96 |
| 1,0270 | 19 | 1,0571 | 45 | 1,0737 | 71 | 1,0625 | 97 |
| 1,0284 | 20 | 1,0580 | 46 | 1,0740 | 72 | 1,0604 | 98 |
| 1,0298 | 21 | 1,0589 | 47 | 1,0742 | 73 | 1,0580 | 99 |
| 1,0311 | 22 | 1,0598 | 48 | 1,0744 | 74 | 1,0553 | 100 |
| 1,0324 | 23 | 1,0607 | 49 | 1,0746 | 75 | | |
| 1,0337 | 24 | 1,0615 | 50 | 1,0747 | 76 | | |
| 1,0350 | 25 | 1,0623 | 51 | 1,0748 | 77 | | |

Note: The specific gravities above 1,0553 indicate two solutions of different strength. In order to ascertain whether an acid is being dealt with whose percentage of acetic acid exceeds the maximum of density (78%), it is only necessary to add some water. If the specific gravity increases, the acid is stronger than 78%, if it decreases, it is weaker.

Oxalic Acid, $C_2O_4H_2 + 2H_2O$, mol. weight 126, is put upon the market in white monoclinic crystals. It impairs the fibre in steaming. Oxalic acid is used in wool dyeing as a reducing agent for bichromate, as an auxiliary in Indigo discharge printing, and also for the preparation of oxalate of tin, oxalate of lime etc.

Tartaric Acid, $C_4O_6H_6$, mol. weight 150, crystallizes in large white prisms, and is used in dyeing and printing as a solvent, which prevents the lake formation.

Specific Gravity of Tartaric Acid at 59° F.
(Gerlach).

| Spec. Grav. | Per cent | Spec. Grav. | Per cent | Spec. Grav. | Per cent | Spec. Grav. | Per cent |
|-------------|----------|-------------|----------|-------------|----------|-------------|-----------------|
| 1,0045 | 1 | 1,0761 | 16 | 1,1615 | 32 | 1,2568 | 48 |
| 1,0090 | 2 | 1,0865 | 18 | 1,1726 | 34 | 1,2696 | 50 |
| 1,0179 | 4 | 1,0969 | 20 | 1,1840 | 36 | 1,2828 | 52 |
| 1,0273 | 6 | 1,1072 | 22 | 1,1959 | 38 | 1,2961 | 54 |
| 1,0371 | 8 | 1,1175 | 24 | 1,2078 | 40 | 1,3093 | 56 |
| 1,0469 | 10 | 1,1282 | 26 | 1,2198 | 42 | 1,3220 | 57,9(saturated) |
| 1,0565 | 12 | 1,1393 | 28 | 1,2317 | 44 | | |
| 1,0661 | 14 | 1,1505 | 30 | 1,2441 | 46 | | |

Ethyl Tartaric acid, $C_4H_5O_6 \cdot C_2H_5$, is put upon the market as a solution of 22° Tw., and is used as an addition to basic printing colours instead of tartaric acid or acetine. It decomposes only on steaming, and does not impair the fibre so readily as tartaric acid.

Citric acid, $C_6O_7H_8 + H_2O$, mol. weight 210, forms colourless crystals and dissolves in $\frac{3}{4}$ parts cold and $\frac{1}{2}$ part boiling water. Like tartaric acid, it is used as a discharge for metallic mordants, and, like tartaric and oxalic acid, impairs the vegetable fibre on steaming.

Lactic acid, $CH_3CH(OH)COOH$, mol. weight 90, is put upon the market as a solution of 50%. It injures the cotton fibre very little and is used for dissolving the base in printing with Diphenyl Black; it also serves as a reducing agent for bichromate in mordanting wool.

Tannin or Tannic acid, $C_{14}H_{10}O_9 + 2H_2O$, mol. weight 358 is brought upon the market in the form of needles, or as a pale yellow to brown powder. Tannin is tested either by titration with permanganate of potassium in presence of Indigo solution, or by sample dyeing, in which case the light shades of Magenta and Methylene Blue Tannin Lakes are specially adapted for determining the fixing strength and purity of the tannin.

Specific Gravity of Solutions of Tannin at 59° F.
(Trammer).

| Spec. Grav. | Per cent | Spec. Grav. | Per cent | Spec. Grav. | Per cent | Spec. Grav. | Per cent |
|-------------|----------|-------------|----------|-------------|----------|-------------|----------|
| 1,0040 | 1,0 | 1,0140 | 3,5 | 1,0242 | 6 | 1,0572 | 14 |
| 1,0060 | 1,5 | 1,0160 | 4,0 | 1,0324 | 8 | 1,0656 | 16 |
| 1,0080 | 2,0 | 1,0180 | 4,5 | 1,0406 | 10 | 1,0740 | 18 |
| 1,0100 | 2,5 | 1,0200 | 5,0 | 1,0489 | 12 | 1,0824 | 20 |
| 1,0120 | 3,0 | | | | | | |

Besides Tannin are used:

Sumach and Sumach Extract,
Gall Nuts,
Myrabolams.

The percentage of tannic acid in these products varies. On an average 1 lb. of tannin is equivalent to

4 lbs. Sumach Leaves
2 lbs. Sumach Extract 67° Tw.
1,4 lbs. Gall Nuts
3 lbs. Myrabolams.

22. Hydrosulphite Preparations.

Sodium Hydrosulphite, $\text{Na}_2\text{S}_2\text{O}_4$, mol. weight 174, is obtained by the reduction of bisulphite with zinc dust and is principally used for setting and working the Hydrosulphite Indigo vat.

Hydrosulphite O Hoechst is a fairly stable Hydrosulphite compound, it must, however, be kept in a cool place.

Hydrosulphite conc. Powder is sodium Hydrosulphite, free from water, and withstands the influence of air.

Hydrosulphite NF consists of a molecular mixture of Formaldehyde Hydrosulphite and Formaldehyde Bisulphite $\text{NaHSO}_3 \cdot \text{CH}_2\text{O} + 2\text{H}_2\text{O} + \text{NaHSO}_3 \cdot \text{CH}_2\text{O} + 2\text{H}_2\text{O}$ and contains about 44% $\text{NaHSO}_3 \cdot \text{CH}_2\text{O} + 2\text{H}_2\text{O}$. Protected from dampness and excessive heat, the substance keeps for months. In moist air it is apt to liquify; it melts on the water bath at 122° F. without losing its reducing properties. Hydrosulphite NF has found extensive use in printing with Indigo and Sulphur colours, in discharging ice and direct dyeing colours, and also for cleansing the white in goods printed with ice colours.

Hydrosulphite NFW contains Lithopone in addition to Hydrosulphite NF, and is used for discharging wool. The addition of Lithopone prevents the sinking into the cloth of the easily soluble discharge and embellishes the discharged white.

Hydrosulphite NF conc. is a new compound of Formaldehyde Hydrosulphite, and contains 88% $\text{NaHSO}_3 \cdot \text{CH}_2\text{O} + 2\text{H}_2\text{O}$, mol. weight 154. It has twice the discharging strength of Hydrosulphite NF, is more stable than the latter, and is specially adapted for very concentrated white and coloured discharges.

Zinc Hydrosulphite or **Hydrosulphite Z** was formerly used for discharging Alpha Naphthylamine Claret and for printing with Indigo. Recently, however, it has been entirely superseded by the stable compounds of sodium-hydrosulphite-formaldehyde.

Hydrosulphite AZ is a basic compound of zinc-hydrosulphite formaldehyde. It is white, insoluble in water, and is used as a stripping agent in dyeing.

23. Oils and Soaps.

Olive Oil, specific gravity 0,914 to 0,917 is used in Turkey Red dyeing. Tournant oil, used in the Old Red method, is a rancid olive oil produced by artificial oxidation. Olive oil is added to printing colours, in order make them work smoothly.

Oleine, $C_{17}H_{31} \cdot COOH$ is a bye product in the manufacture of stearic acid. In the pure state it forms a colourless oil which solidifies in the cold, and melts at $57^{\circ} F$. Oleine forms an easily soluble alkaline salt, and is used as a spinning assistant for wool, and also for the production of soap. When used as a spinning assistant, Oleine must be free from difficultly saponifiable or unsaponifiable impurities, especially mineral oils and stearine.

Castor Oil, specific gravity 0,960 to 0,964, is used for the preparation of Turkey red oil and chlorine oil.

Softening. Under this name preparations are put upon the market which are emulsions of oil in soap, often mixed with glycerine, silicate, or even starch.

There are sodium and potassium softening on the market. The former are less effective than the latter, but they have this advantage that they prevent the added oil from becoming rancid. The softeners are obtained by mixing a warm alkali solution with an excess of oil, so that a neutral soap plus oil results. The mixture is then boiled whilst being stirred. Another process is, to add oil to a warm soap solution and to heat the mixture to boiling point. The second method permits of combining two different fats, such as olive oil with palm oil soap.

Olive oil is suitable for soda softening; tallow, as free fat for potash softening. Three parts dry soap are mixed with 1 part oil and 7 parts water.

Monopole Soap manufactured by Stockhausen and Traiser of Crefeld, **Turkone Oil** by Buch and Landauer, Berlin and **Monopole Oil** by Dr. A. Schmitz of Heerdt, etc. are soaps whose solutions have a weak acid reaction, and whose lime salts and magnesium salts are soluble in an excess of the soaps. They are therefore advantageously employed with hard water.

Lizarol D conc. is a new, patented, fat mordant, soluble in water, which is used in printing Alizarine Red and pink on oiled goods. The printing colours prepared with it are quite as stable as those prepared without such a fatty mordant, and the prints are equal in beauty and fastness to those produced on previously oiled goods.

Para Soap PN is obtained by partial neutralization of ricinoleic acid with ammonia. It is extensively used as an addition to the naphthol prepares in dyeing and printing with Paranitraniline, on account of its particularly favourable effect upon the shade.

Chlorine Oil is obtained by mixing castor oil with chloride of lime solution. If added to the Alizarine Red printing colours, a more brilliant red is produced.

Chlorine oil is prepared in the following manner:

1 part Castor Oil and

1 part Chloride of Lime Solution $3^{\circ} Tw.$ are well mixed.

Turkey Red Oils are sulphonated castor oils which are largely used in dyeing, printing and bleaching vegetable substances. There are soda and ammonia Turkey red oils. The former, discovered and first introduced into practice in 1877 by Dr. A. Wuth at Ramsbottom, the latter, discovered by Fritz Stork, effected a great revolution in dyeing, especially in Turkey red dyeing.

Turkey Red Oil Analysis.

Primary Test. The oil must react slightly alkaline or neutral. Mixed with water a perfect emulsion must be obtained from which oil drops are separated after standing for some time. These oil drops must be perfectly soluble in ammonia, otherwise unsaponified fat is present.

Total Fat. 100 cc of the oil to be analysed are mixed in a narrow graduated cylinder with 20 cc hydrochloric acid conc.; and then made up with saturated salt solution to 500 cc. The whole is heated whilst being frequently shaken. On cooling the fat swims on the salt solution. The number of cc indicates the sum total of fat sufficiently accurately for practical purposes.

It is also advisable to test the soaps from time to time.

Soap Analysis.

Water. A certain quantity of soap, say 3 g is mixed with about 10 g perfectly dry quartz sand in a porcelain dish, and the whole weighed. After adding a little alcohol, to accelerate the evaporation of the remaining water, the mixture is dried until a constant weight is obtained. The loss indicated by the difference in weight represents water.

Fatty Acid. A quantity of soap, say 3 g, accurately weighed is dissolved with water in a porcelain dish. The fatty acid is then precipitated with an excess of normal sulphuric acid, and melted with 10 g pure and perfectly dry wax. The wax cake which easily separates on cooling, is rinsed in cold water, dried first with filter paper and then in the desiccator until a constant weight is obtained.

Total Alkali. The filtrate obtained by the fatty acid test is neutralized with normal soda lye and Phenolphthaleine. The number of cc soda lye used, deducted from the number of cc normal sulphuric acid shows the sum total of alkali, 1 cc normal sulphuric acid being equivalent to 0.031 g Na_2O .

Another method is to titrate 100 cc soap solution containing 2—3 g soap direct with normal acid and Methyl Orange until a red tinge appears: 1 cc normal acid is equal to 0.031 g Na_2O .

Free Alkali. Qualitative Test. If a freshly cut surface of the soap is touched with a few drops of mercury chloride solution a brownish-yellow to reddish-brown colour will appear, according to the amount of free alkali.

Glycerine. 20—25 g soap are dissolved in 100 cc water, then the fatty acid precipitated with sulphuric acid till acid reaction sets in, and removed with wax. The filtrate is neutralized with potash, evaporated till dry, powdered and extracted with pure alcohol. The extracted solution is filtered into a glass of known tare and heated on a water bath or, better still, to 122—140° F. until constant weight is obtained. The residue is glycerine.

Unsaponified Fat. About 20—25 g very finely powdered and dried soap are extracted with ligroine in the Soxhlet's extraction apparatus for 3—4 hours, the ligroine evaporated and the fat

weighed. Traces of soap being soluble in ligroine, a portion of the soap separated in the flask must be poured off, rinsed and the corresponding correction be made: 100 cc ligroine dissolve 0.01 g olive oil soap.

24. Solvents.

Methyl Alcohol (Wood Spirit) CH_3OH , mol. weight 32, and **Ethyl Alcohol** (Spirits of Wine) $\text{C}_2\text{H}_5\text{OH}$, mol. weight 46, are used as solvents for basic dyestuffs. The specific gravity is ascertained by means of the areometer.

Specific Gravity of Aqueous Alcohol at 60° F. (Tralles).

Water = 0.9991.

| Spec. Grav. | Vol. Per cent Alcohol | Spec. Grav. | Vol. Per cent Alcohol | Spec. Grav. | Vol. Per cent Alcohol |
|-------------|-----------------------|-------------|-----------------------|-------------|-----------------------|
| 0.9976 | 1 | 0.9583 | 35 | 0.8917 | 69 |
| 0.9961 | 2 | 0.9570 | 36 | 0.8892 | 70 |
| 0.9947 | 3 | 0.9559 | 37 | 0.8867 | 71 |
| 0.9933 | 4 | 0.9541 | 38 | 0.8842 | 72 |
| 0.9919 | 5 | 0.9526 | 39 | 0.8817 | 73 |
| 0.9906 | 6 | 0.9510 | 40 | 0.8791 | 74 |
| 0.9893 | 7 | 0.9494 | 41 | 0.8765 | 75 |
| 0.9881 | 8 | 0.9478 | 42 | 0.8739 | 76 |
| 0.9869 | 9 | 0.9461 | 43 | 0.8712 | 77 |
| 0.9857 | 10 | 0.9444 | 44 | 0.8685 | 78 |
| 0.9845 | 11 | 0.9427 | 45 | 0.8658 | 79 |
| 0.9834 | 12 | 0.9409 | 46 | 0.8631 | 80 |
| 0.9823 | 13 | 0.9391 | 47 | 0.8603 | 81 |
| 0.9812 | 14 | 0.9373 | 48 | 0.8575 | 82 |
| 0.9802 | 15 | 0.9354 | 49 | 0.8547 | 83 |
| 0.9791 | 16 | 0.9335 | 50 | 0.8518 | 84 |
| 0.9781 | 17 | 0.9315 | 51 | 0.8488 | 85 |
| 0.9771 | 18 | 0.9295 | 52 | 0.8458 | 86 |
| 0.9761 | 19 | 0.9275 | 53 | 0.8428 | 87 |
| 0.9751 | 20 | 0.9254 | 54 | 0.8397 | 88 |
| 0.9741 | 21 | 0.9234 | 55 | 0.8365 | 89 |
| 0.9731 | 22 | 0.9213 | 56 | 0.8332 | 90 |
| 0.9720 | 23 | 0.9192 | 57 | 0.8299 | 91 |
| 0.9710 | 24 | 0.9170 | 58 | 0.8265 | 92 |
| 0.9700 | 25 | 0.9148 | 59 | 0.8230 | 93 |
| 0.9689 | 26 | 0.9126 | 60 | 0.8194 | 94 |
| 0.9679 | 27 | 0.9104 | 61 | 0.8157 | 95 |
| 0.9668 | 28 | 0.9082 | 62 | 0.8118 | 96 |
| 0.9657 | 29 | 0.9059 | 63 | 0.8077 | 97 |
| 0.9646 | 30 | 0.9036 | 64 | 0.8034 | 98 |
| 0.9634 | 31 | 0.9013 | 65 | 0.7988 | 99 |
| 0.9622 | 32 | 0.8990 | 66 | 0.7939 | 100 |
| 0.9609 | 33 | 0.8965 | 67 | | |
| 0.9596 | 34 | 0.8941 | 68 | | |

In order to find the percentage of weight from the known percentage of volume, the specific gravity of absolute alcohol (0.7949 according to Gay-Lussac, 0.7999 according to Trallas) is divided by the specific gravity of the spirit to be tested, and the quotient is multiplied by percentage of volume of this spirit.

Glycerine, $C_3H_5(OH)_3$, mol. weight 92, is a colourless viscous fluid of sweet taste. It is very hygroscopic. Glycerine is an excellent solvent for many dyestuffs; it is used as an addition to printing colours and in finishing, also in slubbing printing.

Specific Gravity of Glycerine.

| Per cent Water | Spec. Grav. by Champion & Pellet | Degrees Ré by Berthelot | Per cent Water | Spec. Grav. by Champion & Pellet | Degrees Ré by Berthelot |
|----------------|----------------------------------|-------------------------|----------------|----------------------------------|-------------------------|
| 0 | 1.2640 | 31.2 | 11 | 1.2350 | 28.6 |
| 1 | 1.2612 | 30.9 | 12 | 1.2322 | 28.3 |
| 2 | 1.2585 | 30.7 | 13 | 1.2295 | 28.0 |
| 3 | 1.2560 | 30.4 | 14 | 1.2270 | 27.7 |
| 4 | 1.2532 | 30.2 | 15 | 1.2242 | 27.4 |
| 5 | 1.2505 | 30.0 | 16 | 1.2217 | 27.2 |
| 6 | 1.2480 | 29.8 | 17 | 1.2190 | 26.9 |
| 7 | 1.2455 | 29.6 | 18 | 1.2165 | 26.7 |
| 8 | 1.2427 | 29.3 | 19 | 1.2137 | 26.4 |
| 9 | 1.2400 | 29.0 | 20 | 1.2112 | 26.2 |
| 10 | 1.2375 | 28.8 | 21 | 1.2085 | 25.9 |

Benzine is a liquid of light weight, its specific gravity being 0.65—0.75, and is used as an addition to printing colours which froth easily.

Turpentine, a colourless liquid of peculiar smell, specific gravity 0.68—0.89, is, like benzine, added to colours in order to prevent them from frothing; it is also used for removing oil stains, from cloth.

Solution Ether is Diethylamine of high percentage, boils at 136° F. It is a colourless liquid of ammonia-like smell. It is used as a solvent for mordant colours.

Formaldehyde, $HCHO$, mol. weight 30, is a volatile compound, easily soluble in water. It has a pungent smell and possesses great affinity for bisulphites, hydrosulphites, albuminous and gluey substances. Formaldehyde is put upon the market as a solution of 40% and is used for the preparation of stable hydrosulphite compounds, as well as in half wool dyeing.

Carbolic Acid or Phenol, C_6H_5OH , mol. weight 94, forms in its pure state, a white crystalline substance, slightly soluble in water. It is poisonous and cauterizes the skin. It is used in finishing as an antiseptic, and furthermore as an addition to coloured discharges produced with Hydrosulphite NF conc., because it prevents the lake formation of Tannin colours without destroying the Hydrosulphite.

Acetine is formed by heating glycerine with Glacial acetic acid, and represents a mixture of Mono-, Di- and Tri-Acetine with free acetic acid. On steaming it separates again into acetic acid and glycerine. It is an effective solvent for basic colours which dissolve with difficulty (Indulines etc.).

25. Finishes and Thickenings.

Glue is put upon the market either in yellowish brown tablets or as a gelatinous paste. In solution it is added to dyebaths, in order to prevent colours from running into the white. It is also used as an addition to finishes and thickenings. In a purified, colourless and easily soluble form it is chiefly employed as **Gelatine** for finishing. When dissolved in water it hardens on cooling. An addition of acetic acid keeps it in a liquid state. Glue solutions easily become putrid; it is therefore advisable to add to them antiseptic substances, such as phenol, salicylic acid, boric acid etc.

Starch is insoluble in cold water. On being heated with water, starch begins to swell at about 140° F and as so-called starch paste forms an excellent thickening. In order to prevent the putrefaction of starch paste, small quantities of antiseptic substances, e. g. salicylic acid or boric acid are added. The different kinds of starch are distinguished by the aid of the microscope. Starch reacts with iodine which serves as a sure means of recognition. Strong heat and acids convert starch into dextrine, and under suitable conditions it is converted into sugar by acids and certain ferments, e. g. diastase.

The following are the most important kinds of starch:

Wheat Starch must not contain more than 15% water, nor leave more than 0.5% ash. The starch is stirred with water and gradually heated whilst continually stirred. It swells and thickens till at a certain moment it begins to thin again. From that moment it must be allowed to cool. This thickening, acidified with acetic acid, is used for printing with basic dyestuffs in deep shades. Besides the water and combustion test, starch should be tested for stability. The starch paste, after standing for some days, is tested with litmus. The longer it keeps without becoming acid, the better is its quality. Starch can also be made into a paste cold by means of strong caustic soda. It is made into a paste with some water and then added to the soda. The starch swells and becomes transparent, forming the so-called apparatine which is used for finishes (the caustic soda has to be neutralized before use).

Rice Starch is little used for thickening, as the paste made from it easily absorbs water. It is, however, used in finishing.

Maize Starch very often takes the place of wheat starch for thickenings and finishes. It is especially suitable for Ice colours.

Potato Starch is most extensively used in finishing. It contains up to 20% water.

Wheat Flour contains nitrogenous substance, the so-called gluten. A good quality must not contain more than 16% water nor leave more than 4% ash. It is used as a thickening agent.

Burnt Starch is obtained by roasting wheat starch and is put upon the market as lighter or darker coloured powders according to the degree of roasting.

British Gum is obtained by roasting maize starch. Like burnt starch, it is put upon the market as lighter or darker coloured powders. The former are less roasted and contain larger quantities of unchanged starch.

Dextrine is obtained from potato flour, and is put upon the market as a white or as a yellow product. It is used for thickenings and finishes.

Leiogomme is likewise obtained by roasting potato flour, and forms a pale yellow powder which is chiefly used for finishing.

Glucose or Grape Sugar is put upon the market in yellowish lumps, it is hygroscopic, and is therefore used in finishing, to maintain a certain degree of moisture in the goods. It is also used in dyeing with certain blue Thiogene colours, and as a reducing agent.

Tragacanth, a dried vegetable sap, is put upon the market in shell-like or leafy pieces. It forms the best thickening ingredient (with 60 g per litre a good thickening is obtained). It is used by itself or also in combination with wheat starch and wheat flour. Tragacanth is mixed with water and left to swell for 24 hours, whereupon it is heated for some time, if possible under pressure, until completely dissolved. The commercial kinds of tragacanth differ largely, it is therefore necessary, before purchasing, to make a thickening test against a known sort.

Carrageen or Iceland Moss, is a species of algae which produces a mucilaginous substance, and is used for finishing, sizing or as a thickening in yarn printing. Hot water is poured over the carrageen moss, which is then left to stand for 12 hours, after which more water is added, the whole boiled and finally strained through a cloth. On cooling the liquid thickens to a gelatine.

Gums. Of these Senegal gum or gum Arabic are mostly used. A good quality should be easily soluble in water, contain few insoluble parts, give a light coloured solution, and should not coagulate with mordants when allowed to stand. Some natural gums have to be softened under pressure or with acids in order to be dissolved. Other sorts are easily soluble and may be added direct to the printing colours in form of powder. For certain colours and discharges the cheaper artificial commercial gum, crystal gum etc can be employed. Colours which are thickened with gum turn out lighter in shade than those thickened with starch.

Albuminous substances are mechanically acting fixing media, and are used in printing with mineral and lake colours. Egg albumen forms transparent amber coloured tablets, and is used for delicate shades. Good egg albumen must be soluble in water without sediment. Blood albumen, though a better fixing medium, is cheaper than egg albumen, but far less pure; consequently it can only be used for dark shades. In order to dissolve albumen, it is best to mix it with water of about 77° F. It gradually falls to the bottom swells and dissolves. A perfect solution is obtained in 24 hours. The darker kinds of albumen possess great thickening and sticking properties. In order to bleach them, their solutions are treated with turpentine.

Additions of ammonia or borax act very favourably in the preparation of albumen solutions. By the reaction of mineral acids, especially at a warm temperature, albumen coagulates completely. This property is made use of in Indigo discharge printing, in order to fix the mineral discharges.

Caseine is little used in printing, because the colours fixed with albumen turn out faster. It is generally dissolved by the addition of borax.

Formaldehyde in solution or also as gas, has a strongly coagulating effect upon albumen and caseine.

26. Aromatic Bases and Naphtols.

Aniline, $C_6H_5NH_2$, mol. weight 93, is in its pure state a colourless oily liquid; specific gravity 1.0265 at 59° F.; boiling point 378° F. It is poisonous. Exposure to air and light turns aniline brown.

Aniline Salt or **Hydrochloride of Aniline**, $C_6H_5NH_2 \cdot HCl$, is a colourless substance, which crystallizes mostly in large leaves. It is very soluble in water and alcohol, and melts at 378° F. It is put upon the market in the form of leafy or lumpy aggregates which, on prolonged exposure to damp air and light, turn dark-green.

Aniline salt often contains free hydrochloric acid. To test the presence of free hydrochloric acid Methyl Violet paper, which turns green in the presence of free mineral acids is used.

Sulphate of Aniline is also an easily crystallizing salt which however, contrary to aniline salt, is not very soluble in water and alcohol.

Aniline salts are tested partly by dyeing or printing of samples, partly by separating the aniline by means of soda lye. The separated oil can then be either measured, weighed after being well dried, or subjected to a distillation.

Diphenyl Black Base I or **P-Amidodiphenylamine**, mol. weight 184, forms, in its chemically pure state, small colourless glittering leaves which melt at 151° F and turn grey when exposed to air. It does not dissolve easily in water, but is easily soluble in alcohol or ether, also in acetic acid. With acids it forms salts which do not easily dissolve, such as the sulphate. Both ferro- and ferricyanide salts are likewise little soluble, but the latter is sometimes employed in printing colours.

Diphenyl Black Oil is p-Amidodiphenylamine dissolved in Aniline oil. It is used for cheap blueish blacks which are not expected to turn green.

Orthotoluidine and **Metatoluidine** are, like aniline, oily liquids which boil at 337° F. and resemble aniline in their chemical properties.

Paratoluidine is a solid substance which melts at 113° F. and boils at 339° F.

Para-Nitrosodimethylaniline forms small leaves of a bright green colour which melt at 185° F. It volatilizes slightly with steam. Nitrosodimethylaniline and its salts are poisonous and irritate the skin.

P-Nitrosodimethylaniline is put upon the market in a very stable form as a 50% base — **Nitroso Base M** 50%.

P-Nitrosodimethylaniline-chlorhydrate forms sulphur-yellow needles which are easily in water, and melt at 170° F.

Resorcine forms colourless, hygroscopic leaves, which melt at 244° F. Boiling point 530° F. It is easily soluble in water, alcohol and ether, but dissolves with difficulty in cold benzene, and serves for Nitroso Green, Nitroso Brown and Nitroso Blue. Resorcine is sold either as such or, already mixed with the tannin necessary for the lake formation, as **Tannoxyphenol R**.

Paranitraniline, mol. weight 138, is a yellow coloured crystalline substance, melting at 297° F which, although little soluble in hot water, as a base forms salts with mineral acids which dissolves in water. Paranitraniline is sold as a finely ground powder, under the name of Paranitraniline extra.

Paranitraniline is dissolved by heating with muriatic or sulphuric acid. When adding an excess of acid the salt precipitates again on cooling.

Α-Naphtylamine, mol. weight 143, melts at 122° F., and boils at 572° F. It is put upon the market as a base, as an hydrochloride, as a powder and as a 36% paste, and also as a sulphate in the form of a finely ground, easily diazotisable powder, under the name of **Α-Naphtylamine Salt S** powder, which yields more stable diazo solutions than the hydrochloride.

When exposed to air and light Alpha Naphtylamine and its salts are coloured violet to black.

Metanitraniline, mol. weight 138, forms yellow needles. melts at 230° F. and boils at 545° F. It is not easily soluble in water. In diazotising it behaves like Paranitraniline and can also be used in the same manner for dyeing and printing.

Orthonitrotoluidine, mol. weight 151.7, forms large yellow monoclinic needles, and melts at 171.5° F. With Beta Naphtol it gives a bright orange; in its properties it is very similar to Paranitraniline.

Chloranisidine, mol. weight 157.5, forms fine needles, melts at 125.6° F. and boils at 468° F. It dissolves easily in alcohol, ether and benzene. With Beta Naphtol it gives bright scarlet shades.

Benzidine, mol. weight 184, forms large brilliant leaves melting at 251.6° F. It does not easily dissolve in water, but is easily soluble in alcohol and ether. It forms a sulphate which does not dissolve easily. Coupled with Beta Naphtol it gives brown shades, fairly fast to soap.

Tolidine, mol. weight 211.6, forms iridescent leaves melting at 264.2° F. It dissolves easily in alcohol and ether but is not easily soluble in water. In its properties and use it greatly resembles Benzidine.

Dianisidine, mol. weight 244, forms a grey powder melting at 278.6° F. Coupled with Beta Naphtol it gives a dull reddish violet of limited fastness. By the entry of copper into the dyestuff compound, however, a blue of Indigo like hue, very fast to soap and light is produced.

Beta Naphtol, $C_{10}H_7(OH)$, mol weight 144, forms brilliant leaves, and is put upon the market in lumps or ground as a white powder. It melts at $252^{\circ} F.$ and boils at $545^{\circ} F.$ The ground product dissolves quickly in a little hot water on pouring the necessary quantity of soda lye upon it. By a prolonged exposure to air and light Beta Naphtol is apt to turn brownish. It must therefore be kept in well closed vessels.

Alpha Naphtol has very similar properties to Beta Naphtol, and is also put upon the market in lumps or ground. It melts at $201^{\circ} F.$ and boils at $533^{\circ} F.$

Beta Naphtol R (a mixture of Beta Naphtol with the sodium salt of Beta-Naphtol-Monosulphonic Acid F., sold as **Mixing Salt**) serves for producing the bluest shades of Paranitraniline red.

Naphtol D is employed for the production of a Dianisidine Blue which is fairly fast to perspiration.

27. Various Vegetable and Animal Products.

Malt contains the ferment called Diastase, which is capable of converting starch into dextrine or sugar. Malt decoctions are used for removing starchy thickenings, sizings etc. from printed and steamed goods. As diastase loses its efficiency at a higher temperature than $140^{\circ} F.$, the malt baths may only be used tepid.

Diastaphor. Under this name some highly concentrated, soluble preparations of diastase have recently been put upon the market, which will most likely eventually replace malt.

Bran serves as a mild cleansing agent in the finishing of printed goods.

Cow Dung is an important "dunging" agent in dyeing Turkey Red. It can be replaced by mild alkalies such as Phosphate of Soda, Silicate of Soda (Waterglass) etc.

Bees' Wax is a yellowish plastic substance of specific gravity 0.965, insoluble in water and cold alcohol. It melts at $147^{\circ} F.$, dissolves easily in bisulphide of carbon and oil of turpentine. By melting and bleaching in the open air and light (ozone bleach) the yellow wax is transformed into white wax. Additions of tallow, paraffin, ceresine are met with as adulterants. It is used in finishing; it also serves as an addition to certain thickenings and for the production of the so-called wax resists.

Vegetable Wax is put upon the market as Japanese wax, Carnauba wax etc., and is a cheap substitute for bees' wax. The composition and properties of vegetable wax are similar to those of bees' wax.

28. Water.

Mechanical impurities, such as are carried along by rivers and brooks after rain, are most conveniently retained by means of weirs.

Salts principally those of lime and magnesium must be precipitated, if present in large quantities, by chemical means in apparatus specially constructed for the purpose. In most cases soda is used for the precipitation.

Water of more than 15—20° of hardness should be purified, particularly when intended to be used for machine dyeing.

A small excess of soda in the water does no harm in dyeing with Dianil and Thiogene colours. it should, however, be corrected with acetic acid when working with basic colours, aftertreating dyed shades with metal salts etc.

Water containing lime and magnesia salts is called hard water. The degree of hardness varies in different countries, as will be seen from the following table. Water containing bicarbonate of lime loses in boiling half of its carbonic acid, and insoluble carbonate of lime is precipitated (temporary hardness).

Permanent hardness of water is caused by sulphates etc. These do not decompose on boiling and, consequently, do not precipitate. The sum total of temporary and permanent hardness is called the total degree of hardness.

Testing Water for its Degree of Hardness.

Standard Soap Solution. An alcoholic solution of soap containing about 20 g of pure neutral olive oil soap per litre is prepared. This is standardized by means of a solution of crystallized barium chloride ($\text{BaCl}_2 + 2\text{H}_2\text{O}$) containing 0.523 g per litre. 45 cc of standard soap solution should be equivalent to 100 cc of barium chloride. The barium chloride solution corresponds exactly to a water of 12 German degrees of hardness.

Total Degree of Hardness. 100 cc water are filled into a glass stoppered cylinder of about 200 cc capacity. To this some standard soap solution is gradually added until the froth, formed when shaking the cylinder, remains standing above the liquid for 5 minutes. If the water shows more than 12° hardness, 10 cc of the liquid are diluted to 100 cc with distilled water and, then tested as described above. The consumed number of cc of soap solution indicates, according to the table below, the total degree of hardness the water.

Table for determining the Hardness of Water.

| cc Soap | German Degrees of Hardness | cc Soap | German Degrees of Hardness | cc Soap | German Degrees of Hardness | cc Soap | German Degrees of Hardness |
|---------|----------------------------|---------|----------------------------|---------|----------------------------|---------|----------------------------|
| 3,4 | 0,5 | 15,1 | 3,5 | 26,2 | 6,5 | 36,7 | 9,5 |
| 5,4 | 1,0 | 17,0 | 4,0 | 28,0 | 7,0 | 38,4 | 10,0 |
| 7,4 | 1,5 | 18,9 | 4,5 | 29,8 | 7,5 | 40,1 | 10,5 |
| 9,4 | 2,0 | 20,8 | 5,0 | 31,6 | 8,0 | 41,8 | 11,0 |
| 11,3 | 2,5 | 22,6 | 5,5 | 33,3 | 8,5 | 43,4 | 11,5 |
| 13,2 | 3,0 | 24,4 | 6,0 | 35,0 | 9,0 | 45,0 | 12,0 |

Temporary Hardness. Temporary hardness or the proportion of carbonates present in water is best determined by titrating with $\frac{N}{10}$ or $\frac{N}{50}$ standard acid, using Methyl Orange as indicator.

1 cc $\frac{N}{10}$ acid corresponds with 0,0028 g CaO. If the degree of hardness is greater than the total hardness shown by the soap determination, then the water contains some alkaline carbonate.

German degrees of hardness indicate milligrammes of CaO in 100 grs water; French degrees of hardness refer to milligrammes of CaCO_3 in 100 grs water; English degrees of hardness indicate grains of CaCO_3 in 1 gallon water.

Comparative Table of German, English and French
Degrees of Hardness.

| German | English | French | German | English | French |
|--------|---------|--------|--------|---------|--------|
| 0,5 | 0,62 | 0,9 | 5,6 | 7,00 | 10,00 |
| 0,56 | 0,7 | 1,0 | 6,0 | 7,5 | 10,74 |
| 0,7 | 0,87 | 1,26 | 6,16 | 7,68 | 11,00 |
| 0,8 | 1,0 | 1,43 | 6,5 | 8,13 | 11,64 |
| 1,0 | 1,25 | 1,79 | 6,72 | 8,38 | 12,00 |
| 1,12 | 1,41 | 2,0 | 7,0 | 8,75 | 12,55 |
| 1,5 | 1,88 | 2,69 | 7,28 | 9,10 | 13,0 |
| 1,68 | 2,10 | 3,0 | 7,84 | 9,8 | 14,00 |
| 2,0 | 2,5 | 3,58 | 8,0 | 10,0 | 14,30 |
| 2,24 | 2,8 | 4,0 | 8,4 | 10,5 | 15,0 |
| 2,4 | 3,0 | 4,3 | 8,5 | 10,63 | 15,18 |
| 2,5 | 3,13 | 4,48 | 8,8 | 11,0 | 15,75 |
| 2,8 | 3,5 | 5,0 | 8,96 | 11,20 | 16,00 |
| 3,0 | 3,75 | 5,37 | 9,0 | 11,25 | 16,08 |
| 3,2 | 4,0 | 5,73 | 9,5 | 11,88 | 17,0 |
| 3,36 | 4,2 | 6,0 | 10,0 | 12,50 | 17,9 |
| 3,5 | 4,38 | 6,27 | 10,08 | 12,6 | 18,0 |
| 3,92 | 4,9 | 7,0 | 10,4 | 13,0 | 18,6 |
| 4,0 | 5,0 | 7,17 | 10,5 | 13,13 | 18,78 |
| 4,48 | 5,60 | 8,0 | 10,64 | 13,3 | 19,0 |
| 4,5 | 5,63 | 8,06 | 11,0 | 13,75 | 19,68 |
| 4,8 | 6,00 | 8,60 | 11,2 | 14,00 | 20,0 |
| 5,0 | 6,25 | 8,95 | 11,5 | 14,38 | 20,59 |
| 5,04 | 6,30 | 9,00 | 11,76 | 14,07 | 21,0 |
| 5,5 | 6,88 | 9,85 | 12,0 | 15,0 | 21,5 |

Table for determining the Quantity of Acetic Acid required to correct Water.

| Normal acid 1:10 cc per litre water | Temporary Hardness in German degrees | Grammes of Acetic Acid necessary to correct 100 litres water | | |
|---|---|---|-----|-----|
| | | 8° | 7° | 6° |
| 2 | 0,56 | 2,6 | 3 | 4 |
| 4 | 1,12 | 5,2 | 6 | 8 |
| 6 | 1,68 | 7,8 | 9 | 12 |
| 8 | 2,24 | 10,4 | 12 | 16 |
| 10 | 2,80 | 13 | 15 | 20 |
| 12 | 3,36 | 15,6 | 18 | 24 |
| 14 | 3,92 | 18,2 | 21 | 28 |
| 16 | 4,48 | 20,8 | 24 | 32 |
| 18 | 5,04 | 23,4 | 27 | 36 |
| 20 | 5,60 | 26 | 30 | 40 |
| 22 | 6,16 | 28,6 | 33 | 44 |
| 24 | 6,72 | 31,2 | 36 | 48 |
| 26 | 7,28 | 33,8 | 39 | 52 |
| 28 | 7,84 | 36,4 | 42 | 56 |
| 30 | 8,40 | 39 | 45 | 60 |
| 32 | 8,96 | 41,6 | 48 | 64 |
| 34 | 9,52 | 44,2 | 51 | 68 |
| 36 | 10,08 | 46,8 | 54 | 72 |
| 38 | 10,64 | 49,4 | 57 | 76 |
| 40 | 11,20 | 52 | 60 | 80 |
| 42 | 11,76 | 54,6 | 63 | 84 |
| 44 | 12,32 | 57,2 | 66 | 88 |
| 46 | 12,88 | 59,8 | 69 | 92 |
| 48 | 13,44 | 62,4 | 72 | 96 |
| 50 | 14,00 | 65 | 75 | 100 |
| 52 | 14,56 | 67,6 | 78 | 104 |
| 54 | 15,12 | 70,2 | 81 | 108 |
| 56 | 15,68 | 72,8 | 84 | 112 |
| 58 | 16,24 | 75,4 | 87 | 116 |
| 60 | 16,80 | 78 | 90 | 120 |
| 62 | 17,36 | 80,6 | 93 | 124 |
| 64 | 17,92 | 83,2 | 96 | 128 |
| 66 | 18,48 | 85,8 | 99 | 132 |
| 68 | 19,04 | 88,4 | 102 | 136 |
| 70 | 19,60 | 91 | 105 | 140 |
| 72 | 20,16 | 93,6 | 108 | 144 |
| 74 | 20,72 | 96,2 | 111 | 148 |
| 76 | 21,28 | 98,8 | 114 | 152 |
| 78 | 21,84 | 101,4 | 117 | 156 |
| 80 | 22,40 | 104 | 120 | 160 |
| 82 | 22,96 | 106,6 | 123 | 164 |

IV. Conversion Tables. 1. Thermometer Divisions.

| Centi- grade | Réau- mur | Fahren- heit | Centi- grade | Réau- mur | Fahren- heit | Centi- grade | Réau- mur | Fahren- heit |
|-----------------|--------------|-----------------|-----------------|--------------|-----------------|-----------------|--------------|-----------------|
| +100 | +80 | +212 | +53 | +42.4 | +127.4 | +6 | +4.8 | +42.8 |
| 99 | 79.2 | 210.2 | 52 | 41.6 | 125.6 | 5 | 4 | 42 |
| 98 | 78.4 | 208.4 | 51 | 40.8 | 123.8 | 4 | 3.2 | 39.2 |
| 97 | 77.6 | 206.6 | 50 | 40 | 122 | 3 | 2.4 | 37.4 |
| 96 | 76.8 | 204.8 | 49 | 39.2 | 120.2 | 2 | 1.6 | 35.6 |
| 95 | 76 | 203 | 48 | 38.4 | 118.4 | 1 | 0.8 | 33.8 |
| 94 | 75.2 | 201.2 | 47 | 37.6 | 116.6 | 0 | 0 | 32 |
| 93 | 74.4 | 199.4 | 46 | 36.8 | 114.8 | -1 | -0.8 | 30.2 |
| 92 | 73.6 | 197.6 | 45 | 36 | 113 | 2 | 1.6 | 28.4 |
| 91 | 72.8 | 195.8 | 44 | 35.2 | 111.2 | 3 | 2.4 | 26.6 |
| 90 | 72 | 194 | 43 | 34.4 | 109.4 | 4 | 3.2 | 24.8 |
| 89 | 71.2 | 192.2 | 42 | 33.6 | 107.6 | 5 | 4 | 23 |
| 88 | 70.4 | 190.4 | 41 | 32.8 | 105.8 | 6 | 4.8 | 21.2 |
| 87 | 69.6 | 188.6 | 40 | 32 | 104 | 7 | 5.6 | 19.4 |
| 86 | 68.8 | 186.8 | 39 | 31.2 | 102.2 | 8 | 6.4 | 17.6 |
| 85 | 68 | 185 | 38 | 30.4 | 100.4 | 9 | 7.2 | 15.8 |
| 84 | 67.2 | 183.2 | 37 | 29.6 | 98.6 | 10 | 8 | 14 |
| 83 | 66.4 | 181.4 | 36 | 28.8 | 96.8 | 11 | 8.8 | 12.2 |
| 82 | 65.6 | 179.6 | 35 | 28 | 95 | 12 | 9.6 | 10.4 |
| 81 | 64.8 | 177.8 | 34 | 27.2 | 93.2 | 13 | 10.4 | 8.6 |
| 80 | 64 | 176 | 33 | 26.4 | 91.4 | 14 | 11.2 | 6.8 |
| 79 | 63.2 | 174.2 | 32 | 25.6 | 89.6 | 15 | 12 | 5 |
| 78 | 62.4 | 172.4 | 31 | 24.8 | 87.8 | 16 | 12.8 | 3.2 |
| 77 | 61.6 | 170.6 | 30 | 24 | 86 | 17 | 13.6 | 1.4 |
| 76 | 60.8 | 168.8 | 29 | 23.2 | 84.2 | 18 | 14.4 | -0.4 |
| 75 | 60 | 167 | 28 | 22.4 | 82.4 | 19 | 15.2 | 2.2 |
| 74 | 59.2 | 165.2 | 27 | 21.6 | 80.6 | 20 | 16 | 4 |
| 73 | 58.4 | 163.4 | 26 | 20.8 | 78.8 | 21 | 16.8 | 5.8 |
| 72 | 57.6 | 161.6 | 25 | 20 | 77 | 22 | 17.6 | 7.6 |
| 71 | 56.8 | 159.8 | 24 | 19.2 | 75.2 | 23 | 18.4 | 9.4 |
| 70 | 56 | 158 | 23 | 18.4 | 73.4 | 24 | 19.2 | 11.2 |
| 69 | 55.2 | 156.2 | 22 | 17.6 | 71.6 | 25 | 20 | 13 |
| 68 | 54.4 | 154.4 | 21 | 16.8 | 69.8 | 26 | 20.8 | 14.8 |
| 67 | 53.6 | 152.6 | 20 | 16 | 68 | 27 | 21.6 | 16.6 |
| 66 | 52.8 | 150.8 | 19 | 15.2 | 66.2 | 28 | 22.4 | 18.4 |
| 65 | 52 | 149 | 18 | 14.4 | 64.4 | 29 | 23.2 | 20.2 |
| 64 | 51.2 | 147.2 | 17 | 13.6 | 62.6 | 30 | 24 | 22 |
| 63 | 50.4 | 145.4 | 16 | 12.8 | 60.8 | 31 | 24.8 | 23.8 |
| 62 | 49.6 | 143.6 | 15 | 12 | 59 | 32 | 25.6 | 25.6 |
| 61 | 48.8 | 141.8 | 14 | 11.2 | 57.2 | 33 | 26.4 | 27.4 |
| 60 | 48 | 140 | 13 | 10.4 | 55.4 | 34 | 27.2 | 29.2 |
| 59 | 47.2 | 138.2 | 12 | 9.6 | 53.6 | 35 | 28 | 31 |
| 58 | 46.4 | 136.4 | 11 | 8.8 | 51.8 | 36 | 28.8 | 32.8 |
| 57 | 45.6 | 134.6 | 10 | 8 | 50 | 37 | 29.6 | 34.6 |
| 56 | 44.8 | 132.8 | 9 | 7.2 | 48.2 | 38 | 30.4 | 36.4 |
| 55 | 44 | 131 | 8 | 6.9 | 46.4 | 39 | 31.2 | 38.2 |
| 54 | 43.2 | 129.2 | 7 | 5.6 | 44.6 | 40 | 32 | 40 |

For the conversion of

°C into °R multiply by 4, divide by 5,
 °C into °F " " 9, " " 5, add 32
 °R into °C " " 5, " " 4,
 °R into °F " " 9, " " 4, add 32
 °F into °R subtract 32, multiply by 4, divide by 9
 °F into °C " 32, " " 5, " " 9.

2 Specific Gravity and Degrees Bé and Tw.

| Spec. Grav. (at 15°) | Degrees Be'ume | Degrees Twad- dell | Spec. Grav. (at 15°) | Degrees Be'ume | Degrees Twad- dell | Spec. Grav. (at 15°) | Degrees Be'ume | Degrees Twad- dell |
|----------------------------|-------------------|--------------------------|----------------------------|-------------------|--------------------------|----------------------------|-------------------|--------------------------|
| 1,000 | 0 | 0 | 1,185 | 22,5 | 37 | 1,370 | 39,0 | 74 |
| 1,005 | 0,7 | 1 | 1,190 | 23,0 | 38 | 1,375 | 39,4 | 75 |
| 1,010 | 1,4 | 2 | 1,195 | 23,5 | 39 | 1,380 | 39,8 | 76 |
| 1,015 | 2,1 | 3 | 1,200 | 24,0 | 40 | 1,385 | 40,1 | 77 |
| 1,020 | 2,7 | 4 | 1,205 | 24,5 | 41 | 1,390 | 40,5 | 78 |
| 1,025 | 3,4 | 5 | 1,210 | 25,0 | 42 | 1,395 | 40,8 | 79 |
| 1,030 | 4,1 | 6 | 1,215 | 25,5 | 43 | 1,400 | 41,2 | 80 |
| 1,035 | 4,7 | 7 | 1,220 | 26,0 | 44 | 1,405 | 41,6 | 81 |
| 1,040 | 5,4 | 8 | 1,225 | 26,4 | 45 | 1,410 | 42,0 | 82 |
| 1,045 | 6,0 | 9 | 1,230 | 26,9 | 46 | 1,415 | 42,3 | 83 |
| 1,050 | 6,7 | 10 | 1,235 | 27,4 | 47 | 1,420 | 42,7 | 84 |
| 1,055 | 7,4 | 11 | 1,240 | 27,9 | 48 | 1,425 | 43,1 | 85 |
| 1,060 | 8,0 | 12 | 1,245 | 28,4 | 49 | 1,430 | 43,4 | 86 |
| 1,065 | 8,7 | 13 | 1,250 | 28,8 | 50 | 1,435 | 43,8 | 87 |
| 1,070 | 9,4 | 14 | 1,255 | 29,3 | 51 | 1,440 | 44,1 | 88 |
| 1,075 | 10,0 | 15 | 1,260 | 29,7 | 52 | 1,445 | 44,4 | 89 |
| 1,080 | 10,6 | 16 | 1,265 | 30,2 | 53 | 1,450 | 44,8 | 90 |
| 1,085 | 11,2 | 17 | 1,270 | 30,6 | 54 | 1,455 | 45,1 | 91 |
| 1,090 | 11,9 | 18 | 1,275 | 31,1 | 55 | 1,460 | 45,4 | 92 |
| 1,095 | 12,4 | 19 | 1,280 | 31,5 | 56 | 1,465 | 45,8 | 93 |
| 1,100 | 13,0 | 20 | 1,285 | 32,0 | 57 | 1,470 | 46,1 | 94 |
| 1,105 | 13,6 | 21 | 1,290 | 32,4 | 58 | 1,475 | 46,4 | 95 |
| 1,110 | 14,2 | 22 | 1,295 | 32,8 | 59 | 1,480 | 46,8 | 96 |
| 1,115 | 14,9 | 23 | 1,300 | 33,3 | 60 | 1,485 | 47,1 | 97 |
| 1,120 | 15,4 | 24 | 1,305 | 33,7 | 61 | 1,490 | 47,4 | 98 |
| 1,125 | 16,0 | 25 | 1,310 | 34,2 | 62 | 1,495 | 47,8 | 99 |
| 1,130 | 16,5 | 26 | 1,315 | 34,6 | 63 | 1,500 | 48,1 | 100 |
| 1,135 | 17,1 | 27 | 1,320 | 35,0 | 64 | 1,505 | 48,4 | 101 |
| 1,140 | 17,7 | 28 | 1,325 | 35,4 | 65 | 1,510 | 48,7 | 102 |
| 1,145 | 18,3 | 29 | 1,330 | 35,8 | 66 | 1,515 | 49,0 | 103 |
| 1,150 | 18,8 | 30 | 1,335 | 36,2 | 67 | 1,520 | 49,4 | 104 |
| 1,155 | 19,3 | 31 | 1,340 | 36,6 | 68 | 1,525 | 49,7 | 105 |
| 1,160 | 19,8 | 32 | 1,345 | 37,0 | 69 | 1,530 | 50,0 | 106 |
| 1,165 | 20,3 | 33 | 1,350 | 37,4 | 70 | 1,535 | 50,3 | 107 |
| 1,170 | 20,9 | 34 | 1,355 | 37,8 | 71 | 1,540 | 50,6 | 108 |
| 1,175 | 21,4 | 35 | 1,360 | 38,2 | 72 | 1,545 | 50,9 | 109 |
| 1,180 | 22,0 | 36 | 1,365 | 38,6 | 73 | 1,550 | 51,2 | 110 |

| Spec. Grav. (at 15°) | Degrees Beaumé | Degrees Twad- dell | Spec. Grav. (at 15°) | Degrees Beaumé | Degrees Twad- dell | Spec. Grav. (at 15°) | Degrees Beaumé | Degrees Twad- dell |
|----------------------------|-------------------|--------------------------|----------------------------|-------------------|--------------------------|----------------------------|-------------------|--------------------------|
| 1,555 | 51,5 | 111 | 1,660 | 57,4 | 132 | 1,765 | 62,5 | 153 |
| 1,560 | 51,8 | 112 | 1,665 | 57,7 | 133 | 1,770 | 62,8 | 154 |
| 1,565 | 52,1 | 113 | 1,670 | 57,9 | 134 | 1,775 | 63,0 | 155 |
| 1,570 | 52,4 | 114 | 1,675 | 58,2 | 135 | 1,780 | 63,2 | 156 |
| 1,575 | 52,7 | 115 | 1,680 | 58,4 | 136 | 1,785 | 63,5 | 157 |
| 1,580 | 53,0 | 116 | 1,685 | 58,7 | 137 | 1,790 | 63,7 | 158 |
| 1,585 | 53,3 | 117 | 1,690 | 58,9 | 138 | 1,795 | 64,0 | 159 |
| 1,590 | 53,6 | 118 | 1,695 | 59,2 | 139 | 1,800 | 64,2 | 160 |
| 1,595 | 53,9 | 119 | 1,700 | 59,5 | 140 | 1,805 | 64,4 | 161 |
| 1,600 | 54,1 | 120 | 1,705 | 59,7 | 141 | 1,810 | 64,6 | 162 |
| 1,605 | 54,4 | 121 | 1,710 | 60,0 | 142 | 1,815 | 64,8 | 163 |
| 1,610 | 54,7 | 122 | 1,715 | 60,2 | 143 | 1,820 | 65,0 | 164 |
| 1,615 | 55,0 | 123 | 1,720 | 60,4 | 144 | 1,825 | 65,2 | 165 |
| 1,620 | 55,2 | 124 | 1,725 | 60,6 | 145 | 1,830 | 65,5 | 166 |
| 1,625 | 55,5 | 125 | 1,730 | 60,9 | 146 | 1,835 | 65,7 | 167 |
| 1,630 | 55,8 | 126 | 1,735 | 61,1 | 147 | 1,840 | 65,9 | 168 |
| 1,635 | 56,0 | 127 | 1,740 | 61,4 | 148 | 1,845 | 66,1 | 169 |
| 1,640 | 56,3 | 128 | 1,745 | 61,6 | 149 | 1,850 | 66,3 | 170 |
| 1,645 | 56,6 | 129 | 1,750 | 61,8 | 150 | 1,855 | 66,5 | 171 |
| 1,650 | 56,9 | 130 | 1,755 | 62,1 | 151 | 1,860 | 66,7 | 172 |
| 1,655 | 57,1 | 131 | 1,760 | 62,3 | 152 | 1,865 | 67,0 | 173 |

3. Specific Gravity and Degrees Bé under I.

| Degrees Bé | Spec. Grav. 12,5° C | Degrees Bé | Spec. Grav. 12,5° C | Degrees Bé | Spec. Grav. 12,5° C | Degrees Bé | Spec. Grav. 12,5° C | Degrees Bé | Spec. Grav. 12,5° C |
|------------|------------------------------|------------|------------------------------|------------|------------------------------|------------|------------------------------|------------|------------------------------|
| 10 | 1,0000 | 19 | 0,9420 | 28 | 0,8903 | 37 | 0,8439 | 46 | 0,8023 |
| 11 | 0,9932 | 20 | 0,9359 | 29 | 0,8848 | 38 | 0,8391 | 47 | 0,7978 |
| 12 | 0,9865 | 21 | 0,9300 | 30 | 0,8795 | 39 | 0,8343 | 48 | 0,7935 |
| 13 | 0,9799 | 22 | 0,9241 | 31 | 0,8742 | 40 | 0,8295 | 49 | 0,7892 |
| 14 | 0,9733 | 23 | 0,9183 | 32 | 0,8690 | 41 | 0,8249 | 50 | 0,7849 |
| 15 | 0,9669 | 24 | 0,9125 | 33 | 0,8639 | 42 | 0,8202 | 51 | 0,7807 |
| 16 | 0,9605 | 25 | 0,9068 | 34 | 0,8588 | 43 | 0,8156 | 52 | 0,7766 |
| 17 | 0,9542 | 26 | 0,9012 | 35 | 0,8538 | 44 | 0,8111 | 53 | 0,7725 |
| 18 | 0,9480 | 27 | 0,8957 | 36 | 0,8488 | 45 | 0,8066 | 54 | 0,7684 |

4. Table of the Tension and Temperature of Steam.

| Tem- pera- ture | Tension in mm | in Atmo- spheres | Pressure on 1 cm in Kos | Tem- pera- ture | Tension in mm | in Atmo- spheres | Pressure on 1 cm in Kos |
|-----------------------|------------------|------------------------|-------------------------------|-----------------------|------------------|------------------------|-------------------------------|
| +40° | 54.906 | 0.072 | 0.07465 | +105° | 906.41 | 1.193 | 1.23236 |
| 45 | 71.391 | 0.094 | 0.09706 | 110 | 1075.37 | 1.415 | 1.46210 |
| 50 | 91.982 | 0.121 | 0.12505 | 115 | 1269.41 | 1.673 | 1.72592 |
| 55 | 117.478 | 0.154 | 0.15972 | 120 | 1491.28 | 1.982 | 2.02755 |
| 60 | 148.791 | 0.196 | 0.20323 | 125 | 1743.88 | 2.294 | 2.37098 |
| 65 | 186.945 | 0.246 | 0.25417 | 130 | 2030.28 | 2.671 | 2.76937 |
| 70 | 233.093 | 0.306 | 0.31692 | 135 | 2353.73 | 3.097 | 3.20013 |
| 75 | 288.517 | 0.380 | 0.39227 | 140 | 2717.63 | 3.575 | 3.69400 |
| 80 | 354.643 | 0.466 | 0.48217 | 145 | 3125.55 | 4.112 | 4.24050 |
| 85 | 433.041 | 0.570 | 0.58877 | 150 | 3581.23 | 4.712 | 4.86904 |
| 90 | 525.450 | 0.691 | 0.71440 | 155 | 4088.56 | 5.380 | 5.55881 |
| 95 | 633.778 | 0.834 | 0.86168 | 160 | 4651.62 | 6.120 | 6.32434 |
| 100 | 760.00 | 1.000 | 1.03130 | | | | |

5. Weights and Measures.

A. The Metrical System.

1 metre (m) = 10 decimetres (dm) = 100 centimetres (cm) = 1000 millimetres (mm).

1 litre (l) = 1000 cubic centimetres (ccm)

1 ton (t) = 1000 kilogrammes (kg).

1 kilogram (kg) = 1000 grammes (g).

B. English Weights and Measures.

1 yard = 3 feet = 0.9144 m.

1 foot = 12 inches.

1 inch = 2.540 cm.

1 gallon = 4 quarts 8 pints = 32 gills = 4.5436 litres.

1 pound (lb) = 16 ounces (oz) = 453.59 g.

1 ton = 20 hundredweights (cwt) = 2240 lbs = 1016 kg.

C. Russian Weights and Measures.

1 Archin = 16 Werchok = 0.7112 m.

1 Pud = 40 Pfund = 16,3805 k.

1 Pfund = 96 Solotnik = 409.5 g.

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